RDT&E CENTER MANAGEMENT BRIEFS

VOLUME III

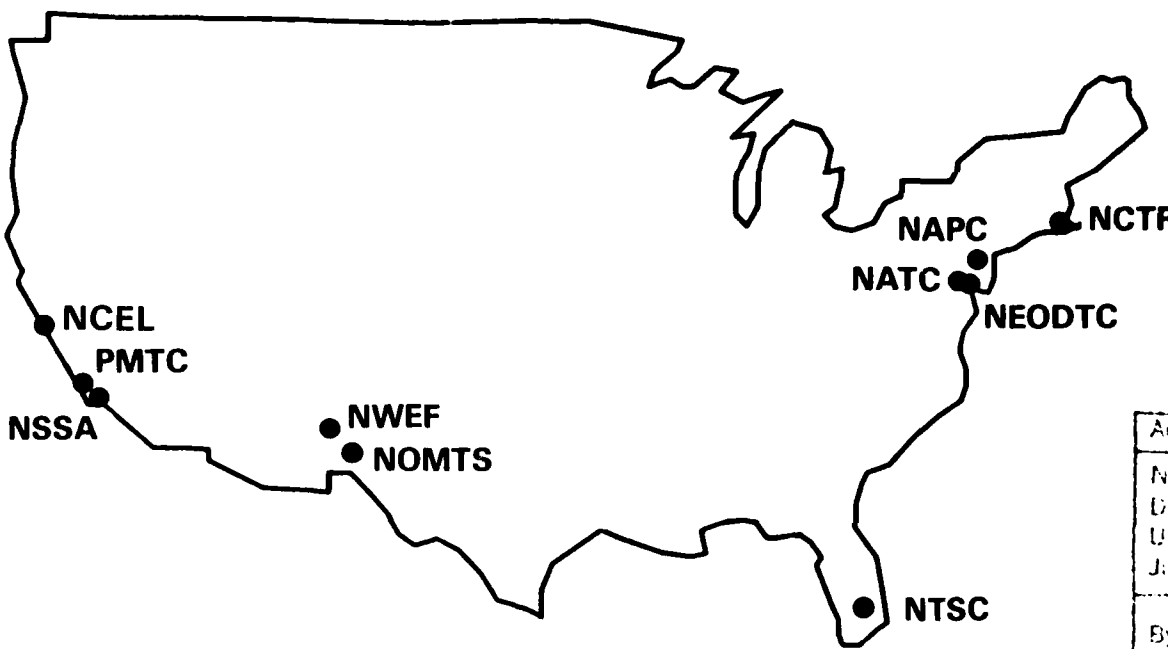
SYSTEMS COMMANDS RDT&E ACTIVITIES

NAVAIRSYSCOM	NAVFACSYSCOM	NAVSEASYSCOM	NAVSUPSYSCOM	SPAWARSYSCOM
NAPC•NATC NTSC•NWEF•PMTC	NCEL	NEODTC•NOMTS	NCTRF	NSSA

SPACE AND NAVAL WARFARE SYSTEMS COMMAND
WASHINGTON, DC

30 SEPTEMBER 1987

LOCATION OF CENTERS



SYSTEMS COMMANDS RDT&E CENTERS

NAVAL AIR SYSTEMS COMMAND

- NAPC – NAVAL AIR PROPULSION CENTER,
- NATC – NAVAL AIR TEST CENTER,
- NTSC – NAVAL TRAINING SYSTEMS CENTER,
- NWEF – NAVAL WEAPONS EVALUATION FACILITY,
- PMTC – PACIFIC MISSILE TEST CENTER,

NAVAL FACILITIES ENGINEERING COMMAND

- NCEL – NAVAL CIVIL ENGINEERING LABORATORY,

NAVAL SEA SYSTEMS COMMAND

- NEODTC – NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CENTER,
- NOMTS – NAVAL ORDNANCE MISSILE TEST STATION,

NAVAL SUPPLY SYSTEMS COMMAND

- NCTRF – NAVY CLOTHING AND TEXTILE RESEARCH FACILITY.

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

- NSSA – NAVY SPACE SYSTEMS ACTIVITY.

FOREWORD

The attached RDT&E center management briefs contain information relative to the missions, facilities, programs, major accomplishments, organization, personnel, funds, and functions/responsibilities of each RDT&E Activity of the Naval Air Systems Command, Naval Facilities Engineering Command, Space and Naval Warfare Systems Command, Naval Sea Systems Command, and the Naval Supply Systems Command. The briefs are intended to provide an accessible source of information pertinent to overall operations of the SYSCOM RDT&E Activities. Users are encouraged to provide SPAWAR 005 with any suggestions regarding the briefs (format, content, etc.).

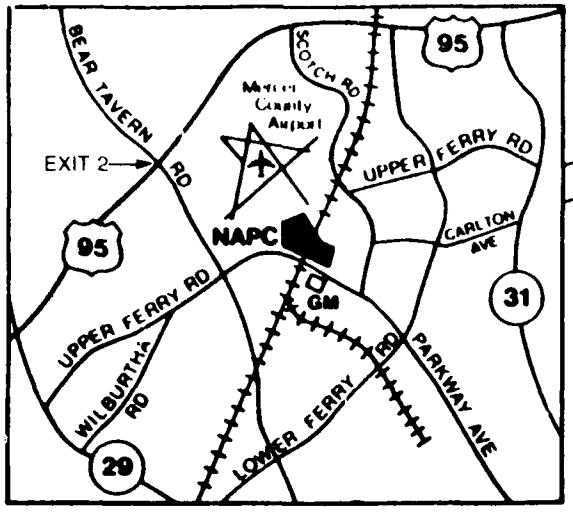
NAVAL AIR PROPULSION CENTER

TRENTON, NEW JERSEY

BRIEF

30 SEPTEMBER 1987

NAPC



Princeton
29
206
1
95
X
TRENTON
Morrisville
130
276
PENNA TPK (TOLL)
Levittown
Pennsylvania
Bristol
SCHUYLKILL RIVER
76
30
PHILADELPHIA
DELAWARE RIVER
Burlington
New Jersey
Camden
Phila International Airport

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NAPC AREA MAP

30 SEPTEMBER 1987

MISSION

To provide complete technical and engineering support for air-breathing propulsion systems, including their accessories and components, and fuels and lubricants, to the Naval Air Systems Command and the fleet by: managing and performing applied research and development leading to new propulsion systems; participating in the development and evaluation of new propulsion systems; conducting propulsion system tests and evaluation as necessary to ensure successful mission accomplishment and assisting in the determination of corrective action necessary for the resolution of operational service problems; and to perform such other functions and tasks as directed by the Commander, Naval Air Systems Command.

INTRODUCTION

The Naval Air Propulsion Center (NAPC), located at Trenton, NJ is one of the Major Range and Test Facility Base (MRTFB) activities under the Naval Air Systems Command Deputy Assistant Commander for Navy Ranges and Field Activity Managment (AIR-42).

The Command takes pride in its "cradle-to-grave" involvement in air propulsion systems and their fuels and lubricants. Center capability includes specification and standards support, technology base maintenance through an integrated exploratory and advanced development program and engineering support and test and evaluation for both developmental and in-service hardware programs. This capability is applied as necessary throughout the life cycle of Navy systems.

As of 30 September 1987, Center assets include 7 officers and 730 civilians of which 221 are scientists and engineers, 126 are aircraft engine or test plant operating mechanics, and 383 are skilled trades, technicians, administrative and temporary, part-time, intermittent. The Center laboratory test facilities are capable of testing propulsion systems at virtually every condition expected to be encountered by Navy aircraft. The funding received in FY 1987 was $41.5M. Approximately 90 percent was received from the principal Center sponsor, the Naval Air Systems Command.

FACILITIES

The Naval Air Propulsion Center (NAPC), located in Trenton, New Jersey, is one of the World's premier facilities for the research, development, test and evaluation of air-breathing propulsion systems. Within the bounds of its 68 acres lie test facilities that possess the ability to simulate any atmospheric condition an aircraft powerplant may encounter in flight. The total acreage, building usage and acquisition costs are as follows:

Land Owned/Leased: 68 acres

Building:

RDT&E	488,390 square feet
Administrative:	27,962 square feet
Other:	92,816 square feet

Acquisition Costs:

Real Property: (Classes I & II)	$52.2 Million
Equipment: (Classes III & IV)	$11.1 Million

The physical plant at NAPC is one of the most unique test facilities in the world. Here, housed in one area, are all the capabilities necessary for the complete testing of jet engines and related accessories. Temperatures from −65 degrees Fahrenheit to 350 degrees and flight speeds from 0 to Mach 3.0 can be generated. Altitude pressures from sea level to 100,000 feet are possible using NAPC's powerful blowers and exhausters which are capable of producing airflows from 0 to 700 pounds per second. In addition, environment conditions such as icing, rain, marine environment, inlet distortion, missile/rocket exhaust gas, gyroscopic loading, sand and dust can be studied at the center.

The Center's test facilities consist of the following. First a Large Engine Test Area (LETA), containing three altitude and two sea level test cells for large turbojet and turbofan engines. Second, a Small Engine Test Area (SETA) with four small sea level/altitude test cells for small gas turbine and reciprocating engines, including turboprop and turboshaft engines up to 7,000-HP class. Third, the Transmission Test Facility which is the nation's only facility capable of testing complete helicopter power drive systems under simulated flight loads. Fourth, the Accessory Test Area utilized to test auxiliary power units and engine starting systems, ram air turbines and air-breathing engine components. Fifth, the Rotor Spin Facility (RSF) with three chambers used to evaluate gas turbine engine rotor structural integrity, durability, and burst protection as well as support development, evaluation, and optimization of rotor designs. Sixth, the Outdoor Test Site (OTS) consists of a Turntable Test Stand (used for free air stream performance evaluations, smoke and pollution measurements, infrared measurements, and humidity effects investigations), the Gyroscopic Test Rig (the only facility in the nation capable of testing full-scale, operating engines undergyroscopic loads) and a Variable Attitude Test Stand (for testing turboprop/turboshaft engines, gearbox and propeller systems at attitudes between −6 to +115 degrees from the horizontal position and rolling plus or minus 50 degrees. The VATS is capable of handling a prop rotor up to 45 feet in diameter). Seventh, the fuels and lubricants laboratory is used to support development of propulsion system fuels and lubricants, preparation of specifications, and solution of service problems and to conduct fluid systems investigations, measure air pollution, and determine life and load bearing characteristics of gear and bearing materials. Finally, the Hot Gas Facility (HGF) is available to conduct combustion research studies, test high-temperature materials and coatings, and evaluate advanced instrumentation in a combustion environment.

HISTORY

The history of the Naval Air Propulsion Center spans over 72 years. From its beginnings at the Washington Naval Shipyard in 1915, the then Aeronautical Engine Laboratory (AEL) initiated the methods for evaluating and testing the rudimentary engines that powered early Navy aircraft.

The rapid growth of aviation soon strained the facilities in Washington and in 1924 AEL was moved to the Philadelphia Naval Shipyard. Testing continued at the Philadelphia site through the 30's and 40's. During this time period many of the most powerful reciprocating engines from all over the world were evaluated. It was also during this time that the U.S. Government, and the Navy began to see that there was a promising future in turbine engine technology. Plans were being formulated for the location and construction of a new facility that offered the capabilities for testing these new powerplants. In 1946, Trenton, New Jersey was selected as the site for the Naval Air Turbine Test Station (NATTS). The property was already owned by the Navy, having served as an acceptance facility for General Motors built Avenger dive bombers during World War II. Construction of a modern test facility was begun in 1949 and completed in 1952 with the first turbine engine test commencing in 1955.

While turbine engine testing progressed at NATTS, AEL continued to evaluate and test reciprocating engines and their lubricants and fuels. In 1967 AEL and NATTS administratively consolidated to form the Naval Air Propulsion Test Center (NAPTC) with AEL becoming the Aeronautical Engine Department. By 1975 physical consolidation was complete with all facilities from AEL moved to Trenton. In 1977 NAPTC changed its name to the Naval Air Propulsion Center (NAPC) to reflect its total involvement in the entire life cycle of propulsion systems.

Today, NAPC remains at the forefront of turbine propulsion technology assuring high performance for the naval aviator.

PROGRAM WORK

Program effort at NAPC represents all facets of aircraft turbine engine systems research, development, qualification and fleet support.

SPECIFICATIONS AND STANDARDS

General Engine Specifications
Turbojet Turbofan: MIL-E-005007E(AS) (Navy Update of MIL-E-5007D)
Turboprop/Turboshaft: MIL-E-008593E(AS) (Navy Update of MIL-E-8593A)
Auxiliary Power Unit: MIL-P-85573
Typical Model Specifications and Performance
Computer Programs

-F404	-T406	-T56
-T700	-TF30	-BQM-126
-F107/F112	-F402	-F110

Domestic and International Hardware Standardization
Auxiliary Power Units and Starting System Components
Fuels, Lubricants and System Components
Propulsion Characteristics Summary and Index
*Specification Deck Management

RESEARCH AND TECHNOLOGY

*IR&D Evaluation
Small Business Innovation Research
Basic Research (ONR) Direction/Coordination
*Exploratory Development; Applied research and advanced technology development for aircraft engines:
- Compression systems (fans/compressors)
- Combustion systems (combustors/augmentors)
- Turbine systems
- Mechanical systems (bearings, shafts and seals)
- Fuel control and delivery systems
- Inlets and exhaust nozzles
- Development of advanced aeromechanical and aerothermo propulsors
- Foreign technology analysis, assessment and exploitation
- Cycle performance analysis of advanced and derivative engines for CTOL and V/STOL aircraft
- Engine cycle and component performance analytical model development
- Cycle performance analysis and technology assessment of components and sub-systems for turbo compound diesel and rotary engines
- Aircraft/engine mission performance capability analysis
- Propulsion system environmental protection assessment and development
- Advanced materials and coatings applications
- Development of methods and systems for hazardous and toxic waste disposal
- Propulsion life cycle cost analysis and assessment
- Technology support for:
  - Fleet service problems
  - 6.3 (Advanced Development) and 6.4 (FSD and CIP)
  - Engine life analysis, assessment and management
- Gas turbine engine hot section materials corrosion assessment testing
- Low observables technology development
- Advanced Fuel Development
- Thermal Barrier Coating Development
- IHPTET (Propulsion & Materials)

PROGRAM WORK (Contd.)

ADVANCED DEVELOPMENT

- *- Joint Navy Air Force Technology Demonstrator Engine (JTDE)
- Modern Technology Demonstrator Engine (MTDE)
- Alternate Fuels Evaluation in F404, T700, T76 and F402 Engines
- Advanced Fuel Management System (AFM)
- Navy Advanced High Pressure Turbine
- Engine Observables Reduction and Prediction
- Advanced Engine Materials/Coatings/Inspection Processes
- Propulsion Manufacturing Technology
- Advanced Inlets/Exhaust Nozzles
- Advanced Seals, Shafts and Dampers
- *- Fuel Flexibility for Current and Future Engines
- Small Turbine Engine Technology
- Advanced Fighter Engine (JAFE) Coordination
- Propulsion Technology Impact Analysis for Advanced Navy Aircraft
- Advance STOVAL Aircraft/Engine Concepts and Design Studies
- Joint Depot Maintenance Analysis Group (JDMAG) Support
- Energy Conservation for Naval Aircraft Propulsion Systems
- Manufacturing Technology Program for Gas Turbine Engines
- IR Signature Prediction for Installed Navy Aircraft Propulsion Systems

ENGINEERING AND OPERATIONAL SYSTEMS DEVELOPMENT AND PRODUCT SUPPORT

Engineering Support and F110 Testing for the F-14A + D
Engineering Support and F404 Testing for the F-18
Altitude Development Testing PW1120
Engineering Support for the F402-RR-406 Engine for AV-8B
Engineering Support for the J52-P-409
Engineering Support for the Uniform Engine Test Program
*Engineering Support and F107/F112 Testing for NAVAIR (Cruise Missiles Project) Air Force Aeronautical Systems Division
Engineering Support for the BOSS Program
Engineering Support for the T700 and Drive System for the SH-2F
Engineering Support for the T700 for the LAMPS Mk III
Engineering Support and T56 Testing for the E-2C
Engineering Support on BQM-126 Program
Engineering Support and Testing for Engine Component Improvement Programs
Engineering Support and Testing for the F404-GE-400D for the A-6F
Engineering Support for the F405 Engine for the T-45 V/STOL Engine Testing Support
F404 Second Source Evaluation, Substantiation and Testing
Engineering Support and F404/RM12 Testing for the JAS-39
Engineering Support and F404 Testing for the F-20 Engine Environmental Testing
Engineering Support for Navy Warranty Program
Engineering Support for T406 for the V-22 Engine and Drive System
*Engineering Support for Navy Test Cell Correlation Program
Engineering Support for Starter and Secondary Power System Field Problems
Engineering Support for TF34 Field Problems

PROGRAM WORK (Contd.)

Engineering Support for Electromagnetic Environmental Effects (E^3) for Engines
Engine Component Reliability and Life Assessment/Verification Analysis and Testing
Rotor Structural Integrity, Durability and Failure Protection
Engine Materials Failure Analysis
Engineering Support for the Pioneer RPV Program
F402-RR-406 Alternate Fuels Effects Test
Engine Part Repair/Rework Technology
Helicopter Drive and Engine Gearbox/Design and Service Performance Evaluation
Starter and Starter Hardware Test and Evaluations
SH-60B APU 1000-Hour ASMET
Engineering Support for F404 and F402 Engine Test Facility Correlation
HARPOON Engine Program Monitoring
HARPOON Engine Quality Assurance Test
Navy Aircraft/Engine IR Suppression System Performance and IR Signature Evaluation and Prediction
F404 Engine Fuel System Durability and Reliability Evaluation
Fuel System Component Test and Evaluation
Fuels and Lubricants Qualification Testing
Fuels and Lubricants Service Performance Evaluation
Fuel/QA Equipment Performance Test and Evaluation
*Relaxed Fuel Specification Investigation
Corrosion Inhibiting Oil Development and Evaluation
*Helicopter Transmission Lubricant Development
SH-60B ID6B 600-Hour SMET Test
H-3 Uprated MGB 900-Hour SMET Evaluation
Bearing Refurbishment and Service Evaluations
Engine Condition Monitoring and Diagnostics Development
Aerial Refueling Components Test and Evaluation
Engine Mission Cyclic Damage Analysis
Engine LCF Structural Integrity and Life Management
Performance Analyses in:
- Proposal Evaluations
- Specification Decks
- Test Support

*Assigned as lead field activity

MAJOR ACCOMPLISHMENTS (FY 1986-1987)

F110-GE-400 ENGINE (F-14A · F14D AIRCRAFT). Production release tests were conducted on two F110 engines and turbine component hardware. Testing on the altitude production release engine consisted of: (1) flight readiness review (FRR) testing which was completed in August 1986 allowing first flight of the F14A + aircraft, (2) an altitude operability and airstart development investigation to resolve improve problems uncovered during FRR testing, and (3) an altitude qualification test which was further extended to investigate an afterburner fuel streaming problem uncovered in flight tests. A corrosion susceptibility test was conducted on the second engine in which 14 of 24 scheduled corrosion test cycles were completed. A non-corrosion induced internal engine hardware failure resulted in premature test termination. Component burst tests were conducted on both the low and high pressure turbine disks. Recent production changes may necessitate an altitude requalification test during FY88.

F404-GE-400 SECOND PRODUCTION SOURCE. On 20 September 1984 a SECNAV memo ordered the establishment of Pratt & Whitney as a second production source for the F404-GE-400 engine. AIR-5361P has formed a consulting group at NAPC to assist in the establishment of the new second source. The questions of technology transfer, proprietary techniques, and definition of the content of the level III data package were addressed. Configuration control board meetings are being held monthly. A drum rotor overspeed test was run successfully in the NAPC spin pit. At the present time, NAPC has initiated altitude and environmental testing to be followed by a 200-hour durability test, which will complete qualification testing of the second source by early 1988. Assurance testing will follow consisting of spin pit and altitude sea level durability testing of a hybrid engine with completion planned for early 1989.

T56-A-427 ENGINE (E-2C AIRCRAFT). NAPC personnel provided technical support to NAVAIR in the following areas: (1) qualification test requirements, engine surge margin requirements design, (2) design of development and acceptance tests to demonstrate surge margin, (3) ASMET engine inspections and durability assessments, and (4) accident investigations of failed engines. The following official qualification test was completed: production release altitude test. The corrosion susceptibility test engine failed a 13th stage blade just prior to corrosion testing. Recommendations for design changes related to reduction gearbox input gear and bearing problems were presented.

SH-60B AND SH-3 DRIVE SYSTEMS. The NAPC transmission test facility was used to test the aircraft power drive systems for the SH-60B and SH-3 aircraft. A 600-hour simulated mission endurance test on the SH-60B system was completed and a 900-hour test on the SH-3 is underway. The main rotor shaft is subjected to thrust and bending loads experienced during these tests. The gearboxes are also loaded through suitable waterbrakes. The object of both tests is to uncover interface problems in the drive systems tested and to demonstrate satisfactory system life.

F402-RR-406 ENGINE (AV-8B AIRCRAFT). Preparation for the F402 alternate fuels effects test to be conducted in FY88 is near completion. A new set of exhaust collector ducting was designed, fabricated, and installed in the test cell. The objective of the test is to investigate engine performance, starting capabilities, smoke point, and emissions using JP-5 and three alternate fuels.

***V-22 PROPULSION SYSTEM SUPPORT* (V-22 AIRCRAFT).** NAPC personnel have been providing technical support to NAVAIR in the following areas of the V-22 development:

MAJOR ACCOMPLISHMENTS (Cont'd)

Allison T406 engine, Bell/Boeing gearboxes and shafting, Turbomach auxiliary power unit, the Garrett shaft driven compressor, the Garrett hydraulic starter, VSLED and ASEMICAP program development, and E^3 design evaluation for digital electronics.

F107/F112 ENGINE (CRUISE AND ADVANCED CRUISE MISSILE ENGINE PROGRAM). Tests such as altitude and sea level performance, mission simulation tests, engine/inlet compatibility tests, starting reliability, stress loading of engine components, surge margin and pyrotechnic ignition were conducted on both production and developmental engines. Long-term storage engines were tested to determine the effects of storage on engine performance. Commenced testing of an enhanced F107-WR-400, -402 version. This will lead to substantiation in FY89. Testing performed on an Advanced Cruise Missile (ACM) engine for the Aeronautical Systems Division at Wright-Patterson Air Force Base included an engine calibration for in-flight thrust determination and warranty testing.

COMPONENT DEVELOPMENT, ANALYSIS AND EVALUATION. Programs completed in the Rotor Spin Facility include: overspeed tests of PW second source F404 compressor (4th to 7th stages) for verification of rotor structural integrity; evaluation of F110-GE-400 low pressure turbine (2nd stage) for determination of disk burst speed; and provided spin test results to characterize the biaxial stress/strain and failure responses of the 3D carbon-carbon composite Shape Stable Nosetip for Trident II, MK5 Reentry Body Development Program at the Naval Surface Weapons Center. Verification of the critical disk safe service life limits in the J52-P-8 engine is a continuing program.

Service Performance (Drive Systems) - NAPC has been involved in drive system service problems and programs to improve reliability, durability and safety in helicopter drive systems. Fleet service problems were investigated and resolved on the following aircraft: CH-46, SH-2, SH-60B, H-3 and CH-53.

In support of fleet reliability assessment, NAPC completed 4265 hours of endurance testing on the F404-GE-400 engine fuel system which verified system integrity. Completed construction of facility to conduct 1000-hour low lubricity evaluation of these components.

In support of Fleet readiness action was taken to: correct inflight failures of the Parleer Hannifin aerial refueling nozzle design; upgrade the J.C. Carter pressurization and vent valve design for the F-18 external tank; correct failures of the Consolidated Controls low level vent valve for the F-14 external tank; and characterize operation of the F-18 external tank refuel/transfer system for potential second sourcing. Technical support was also provided to resolve A-4/KC-135 interoperability refueling problems.

EXPLORATORY DEVELOPMENT (6.2). Programs are underway to design and develop advanced technology components and sub-systems. Accomplishments are:

1. Rig tests of a Transonic/supersonic swept aero fan
2. Engine simulated rig tests of a high temperature combustor
3. Engine demonstration tests of an advanced augmentor
4. Flow visualization tests of advanced turbine film cooling concepts
5. Demonstration of fault tolerant engine controls
6. Engine demonstration tests of advanced high speed counter-rotating carbon seals
7. Endurance tests of high speed counter-rotating thrust and intershaft bearings

Guidance and long range technology plans and assessments

MAJOR ACCOMPLISHMENTS (Cont'd)

were provided to OUSRDR&E for the development of the Integrated High Performance Engine Technology (IHPTET) initiative plans and to NAVAIR for the update of the Naval Aircraft Propulsion Research and Technology Program Plan.

ADVANCED DEVELOPMENT (6.3)/JTDE. A Navy Propulsion Investment Strategy was developed and coordinated through OPNAV, ASN (RE&S) and OUSDRE, expanding the Navy's role in propulsion technology development and demonstration. The strategy is based in projected Navy system requirements and addresses fighter/attack, patrol/surveillance, rotary wing and unmanned air vehicle (both missile and remotely piloted vehicle) air-breathing propulsion needs. As part of this expanded role, the Navy initiated participation in a Joint Turbine Advanced Gas Generator (JTAGG) preliminary design study with the Army and Air Force which will lead to the design, fabrication and test of turboprop/turboshaft (TP/TS) technologies in the 2000-3000 SHP class applicable to future Navy rotary wing aircraft. In the turbofan/turbojet (TF/TJ) arena, the GE23A Program continues toward a FY88 test and two new TF/TJ efforts were initiated to design, fabricate and test the PW699 and GE33 technology demonstrator engines. These programs will demonstrate improvements in aerothermodynamics, structures and materials designed to increase engine performance while improving engine life, maintainability and operability.

SH-60F ENGINE COMPETITION. NAPC has worked with NAVAIR and the AVSYSCOM in preparing the request for proposals for the engine. NAPC personnel have also reviewed the design and some hardware from the T700-GE-401C and the RTM322 candidate engines.

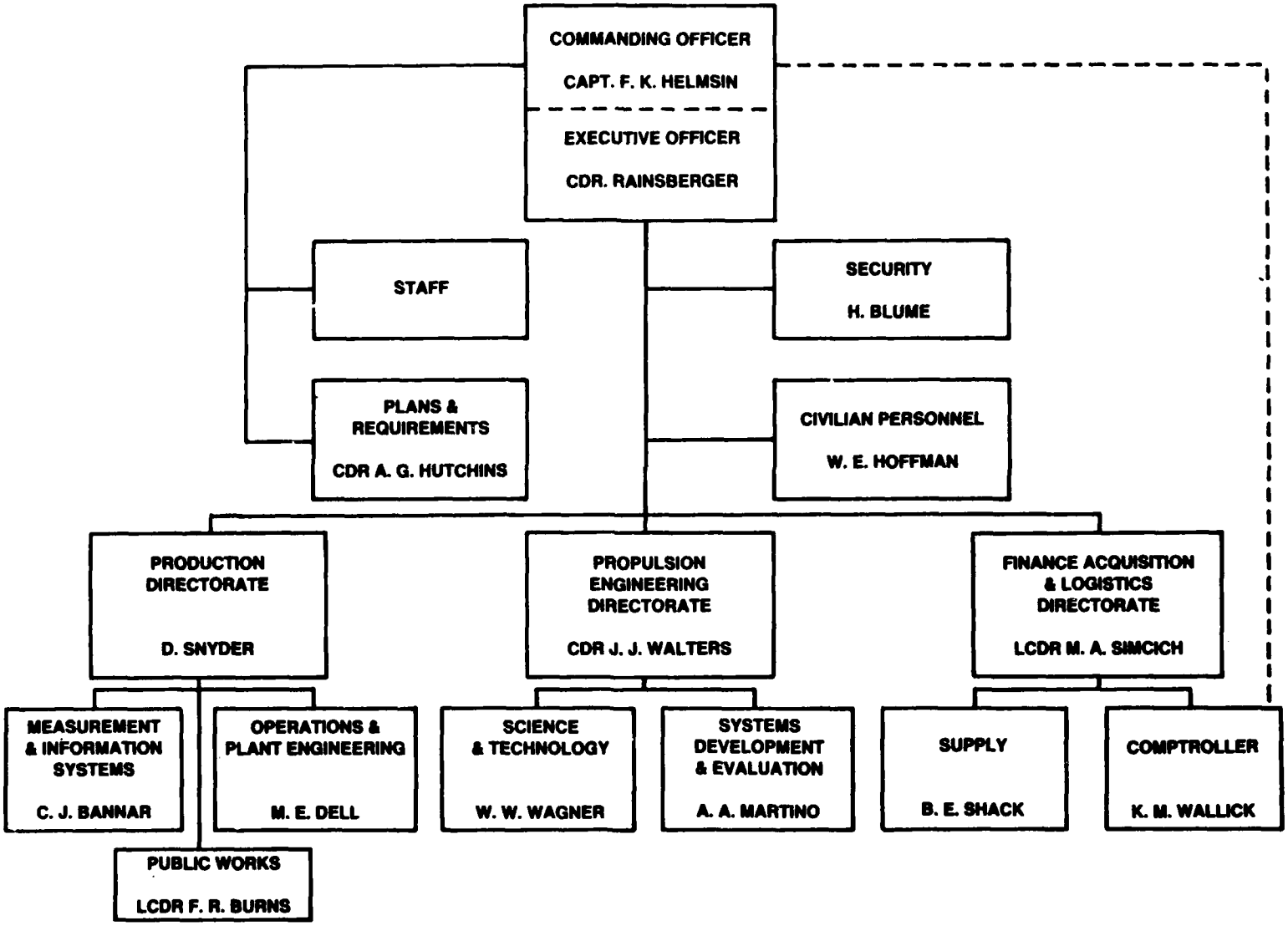
J57-P-19W ENGINE (UNIFORM ENGINE TEST PROGRAM). The NAPC Outdoor Test facility turntable test stand was used to perform a correlation type test of a J57-P-19W engine in support of the AGARD Uniform Engine Test Program (UETP). The purpose of the UETP was to compare performance calculation techniques, instrumentation methods, and test equipment among members of NATO. The results of this program are to be used to provide a basis for standardization of engine test methods within NATO. The NAPC portion of this test program was to test the "sea level" engine, serial number P-615037 at the Outdoor Test Site in order to determine a baseline to which the test data from the other participating facilities is to be compared.

F404-GE-400D ENGINE (A-6F AIRCRAFT). A preliminary flight rating test was conducted to clear the engine for flight. The test included airstarts, sea level performance calibrations and altitude calibrations. The engine met specification requirements except for cold day spooldown airstarts at the top left corner of the starting envelope, and auto relights conducted at Mach No. 1.2. GE is investigating these problems with assistance from NAPC.

F404/RM12. A derivative of the Navy F404-GE-400 engine, termed the RM12 will power the Swedish JAS39 Gripen aircraft. GE/Lynn contracted for time in an altitude cell at NAPC to conduct tests to clear the engine for flight. A test of 240 engine hours was conducted. The testing uncovered digital electronic control anomalies which must be corrected before unrestricted flight is authorized. Engine configuration changes were made and tests beneficial to the Navy's F-18 and EA-6B programs were conducted. Successful results of inlet distortion testing confirmed that the RM12 fan is a viable candidate for a growth F404 engine.

PIONEER RPV ENGINE. NAPC was heavily involved in the investigation of a fleet service problem concerning the loss of Pioneer RPV's due to engine cut-out. Engine altitude testing was conducted to determine the cause of these failures. A fuel system problem was uncovered and the corrective action, a fuel pump modification, was substantiated with testing.

NAPC DEPARTMENTAL ORGANIZATION

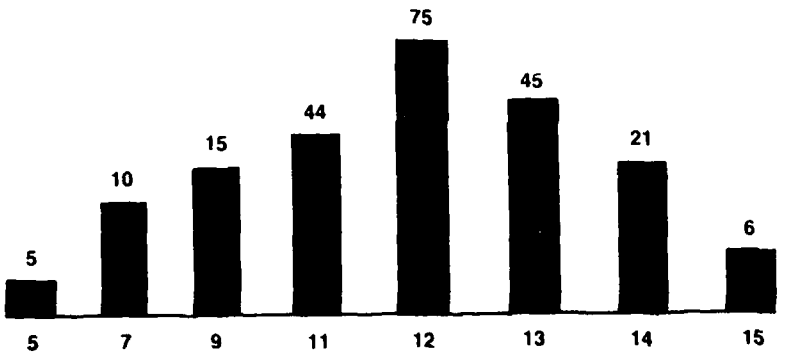


30 SEPTEMBER 1987

NAPC

PERSONNEL

ON BOARD:	TOTAL MILITARY	TOTAL CIVILIANS	FTP*	TPTI**	FTP* UNGRADED	FTP* GRADED
	7	730	690	40	301	389



SCIENTISTS AND ENGINEERS BY GRADE

*FULL-TIME PERMANENT
**TEMPORARY, PART-TIME, INTERMITTENT (SUBJECT TO CEILING)
**INCLUDES METALLURGISTS

ADMINISTRATIVE	29
OTHER	70
TECHNICIANS	69
SCIENTISTS & ENGINEERS	221
GENERAL ENGRS	9
MECHANICAL ENGRS	31
ELECTRONIC ENGRS	17
AEROSPACE ENGRS	122
OTHER ENGRS	19
CHEMISTS	14
MATHEMATICIANS	9

CIVILIAN CEILING: N/A

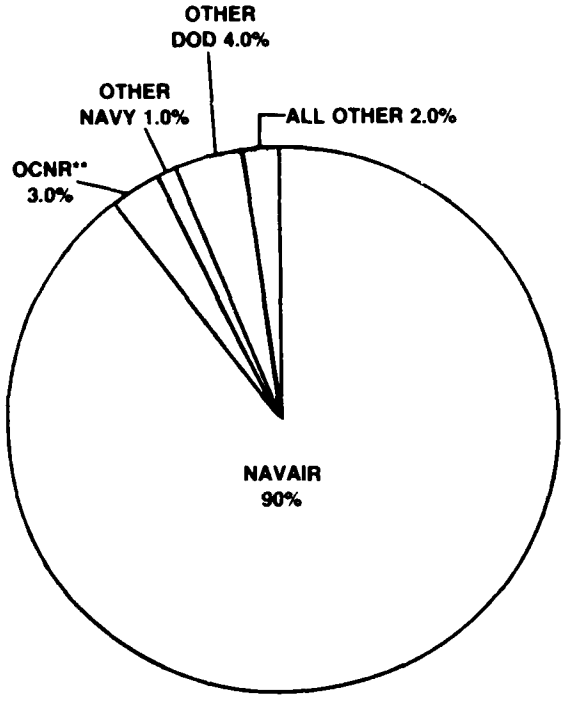
MILITARY ALLOWANCE: 8 OFFICERS

NAPC

SOURCE OF FUNDS

FY 1987

NOR*



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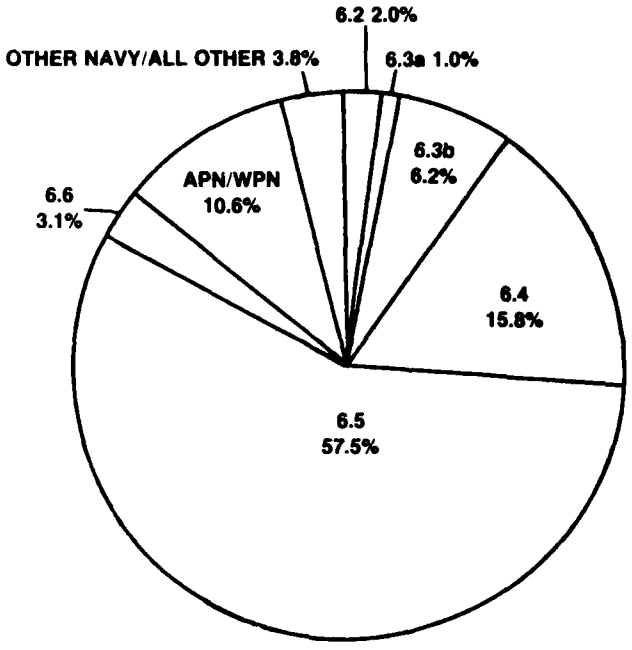

BY APPROPRIATION

*NOR-NEW ORDERS RECEIVED
**OCNR-OFFICE OF CHIEF OF NAVAL RESEARCH

SOURCE OF FUNDS

FY 1988

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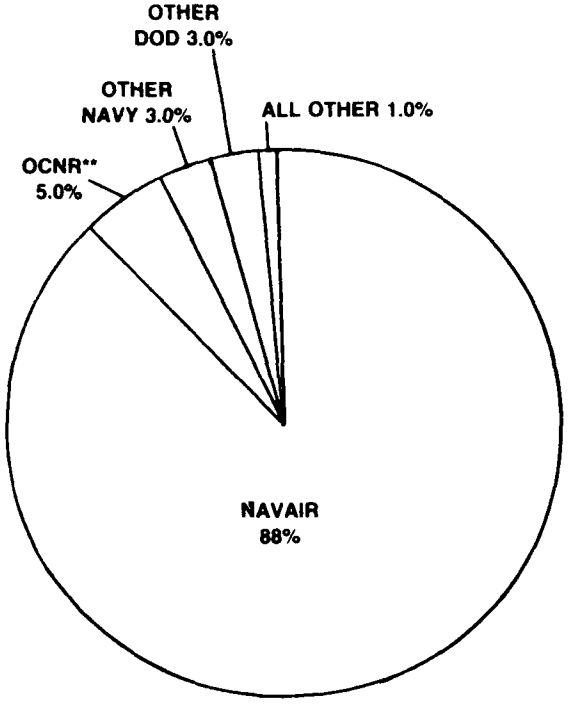

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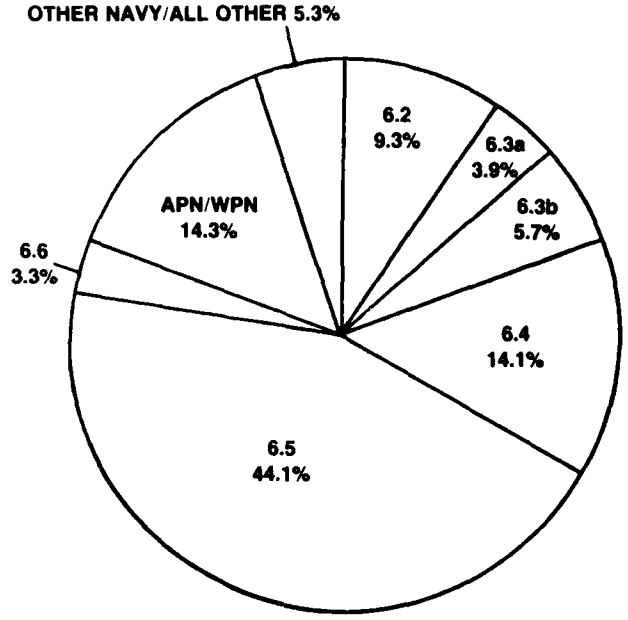


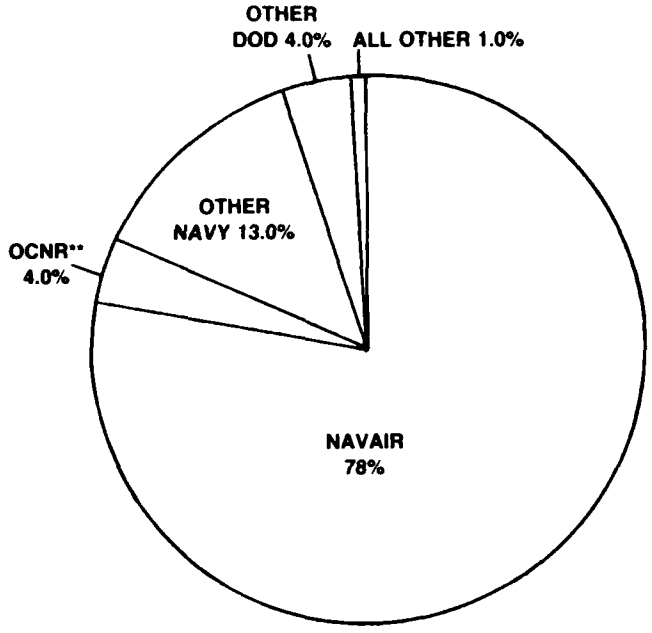
BY APPROPRIATION

*NOR-NEW ORDERS RECEIVED
**OCNR-OFFICE OF CHIEF OF NAVAL RESEARCH

SOURCE OF FUNDS

FY 1989

NOR*



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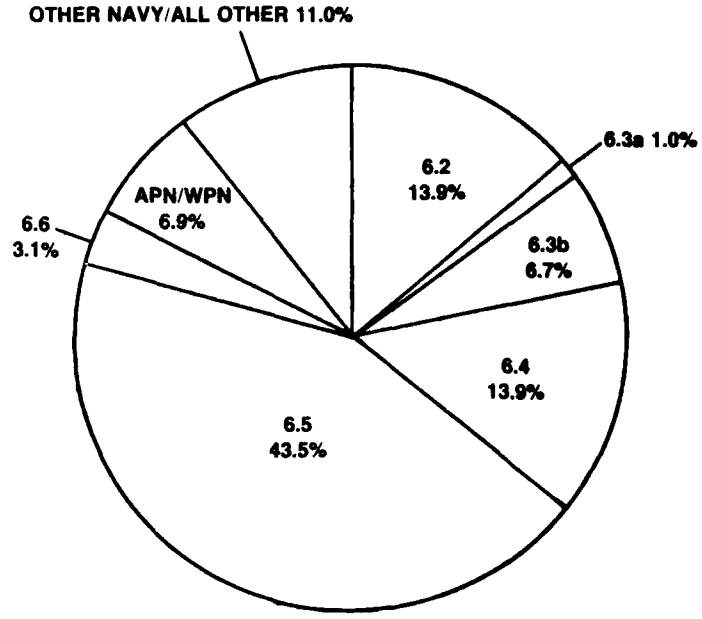


BY APPROPRIATION

*NOR-NEW ORDERS RECEIVED
**OCNR-OFFICE OF CHIEF OF NAVAL RESEARCH

FUNDS BY CATEGORY AND TYPE NOR*
($ in Millions)

CATEGORY & TYPE	FY 87 $M	FY 87 % OF RDT&E	FY 87 % OF TOTAL	FY 88 $M	FY 88 % OF RDT&E	FY 88 % OF TOTAL	FY 89 $M	FY 89 % OF RDT&E	FY 89 % OF TOTAL
6.2 EXPLORATORY DEVELOPMENT	.8	2.2	2.0	5.7	11.6	9.3	8.3	16.9	13.9
6.3a ADVANCED TECHNOLOGY	.3	1.0	1.0	2.4	4.9	3.9	.5	1.0	1.0
SUBTOTAL	1.1	3.2	3.0	8.1	16.5	13.2	8.8	17.9	14.9
6.3b ADVANCED DEVELOPMENT	2.6	7.3	6.2	3.5	7.2	5.7	4.0	8.2	6.7
6.4 ENGINEERING DEVELOPMENT	6.6	18.5	15.8	8.6	17.5	14.1	8.3	16.9	13.9
6.5 MANAGEMENT AND SUPPORT	23.9	67.3	57.5	26.9	54.7	44.1	26.0	53.1	43.5
6.6 OPERATIONAL SYSTEMS DEVELOPMENT	1.3	3.7	3.1	2.0	4.1	3.3	1.9	3.9	3.1
SUBTOTAL	34.4	96.8	82.6	41.0	83.5	67.2	40.2	82.1	67.2
TOTAL RDT&E	35.5	100.0	85.6	49.1	100.0	80.4	49.0	100.0	82.1
APN/WPN	4.4	—	10.6	8.7	—	14.3	4.1	—	6.9
OTHER NAVY/ALL OTHER	1.6	—	3.8	3.2	—	5.3	6.6	—	11.0
SUBTOTAL	6.0	—	14.4	11.9	—	19.6	10.7	—	17.9
TOTAL	41.5	—	100.0	61.0	—	100.0	59.7	—	100.0

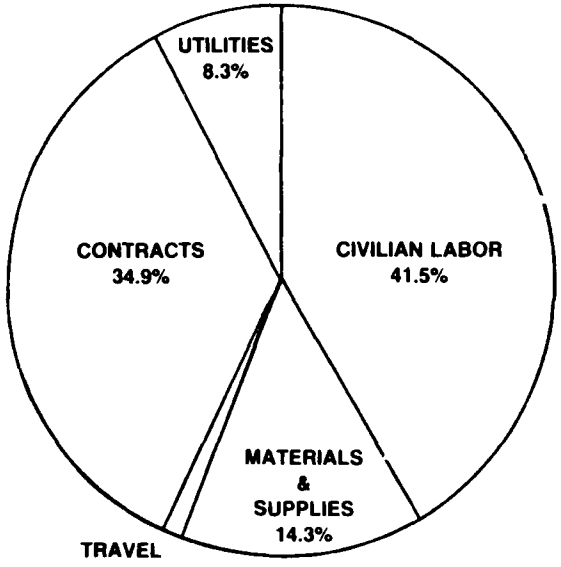
*NOR-NEW ORDERS RECEIVED

NAPC

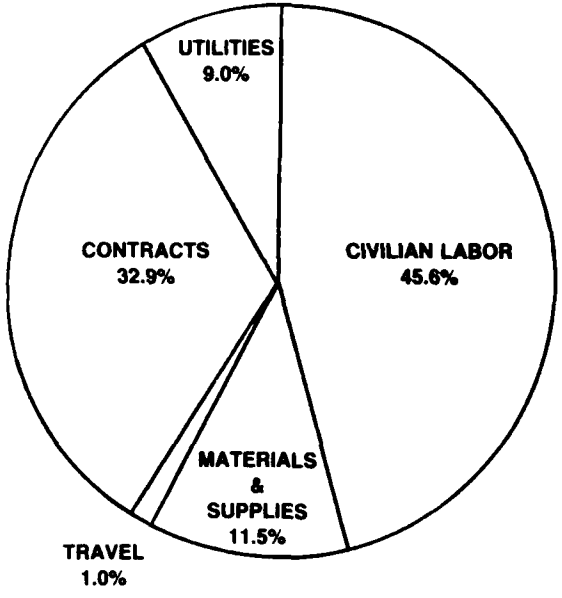
DISTRIBUTION OF FUNDS
($ in Millions)

NOR*

FY 1988
ESTIMATED $61.0



FY 1989
ESTIMATED $59.7



*NOR-NEW ORDERS RECEIVED

30 SEPTEMBER 1987

LEADERSHIP ASSIGNMENTS

AS ASSIGNED BY NAVAIRINST 5451.82

Evaluate air-breathing propulsion systems, their components and accessories through simulated environmental and operational tests, engineering analysis, disassembly, analytical inspection and reassembly of test engines.

Manage and perform applied research, development and engineering work to improve or correct defects in new air-breathing propulsion systems, their components and accessories; support operational requirements; and solve field service problems.

Conduct theoretical research studies and perform experimental laboratory investigation to develop new evaluation procedures and technical requirements for incorporation in specifications used in the procurement and performance evaluation of air-breathing propulsion systems, their components and accessories.

Provide complete engineering and technical advisory and consulting service on matters relating to the development, evaluation and support of new air-breathing propulsion systems.

Conduct tests of air-breathing propulsion systems in support of other governmental departments and agencies and Department of Defense contractors.

Initiate applied research, development and engineering work necessary to provide and maintain facilities and equipment adequate for accomplishment of the mission.

Manage and perform applied research and development related to advanced lubricating oils, engine lubricating-oil wetted components, advanced and synthetic aircraft fuels, and engine air pollutants.

Perform test and evaluation for qualification of all aircraft engine oils, aircraft and engine fuel system components, and field service problems involving fuels, lubricants, and associated hardware.

Formulate, evaluate, monitor and conduct research, exploratory development and advanced development programs as required.

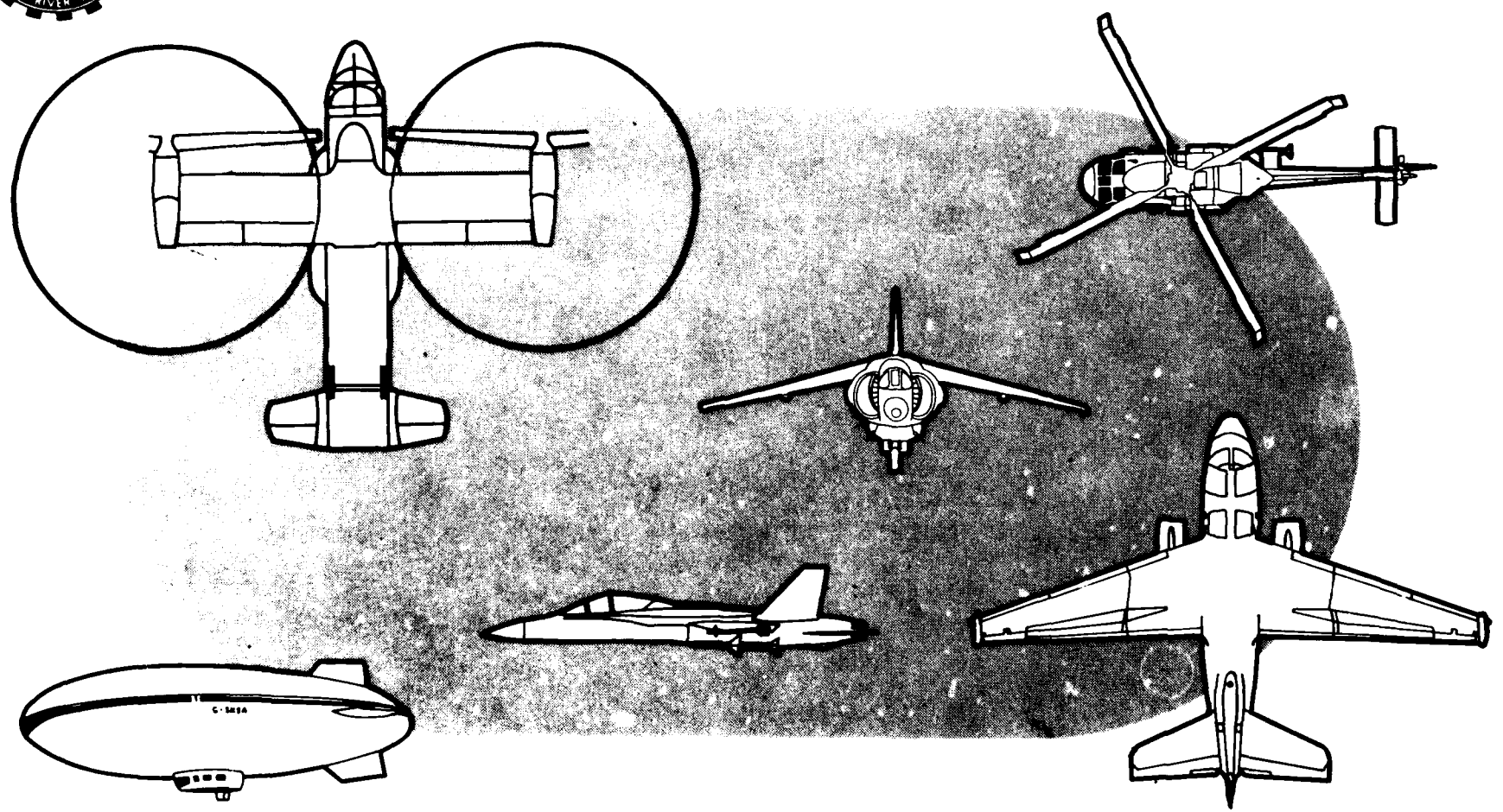
Provide administrative and technical direction to selected contracts of the Naval Air Systems Command.

Provide administrative and logistic support to assigned activities as required.

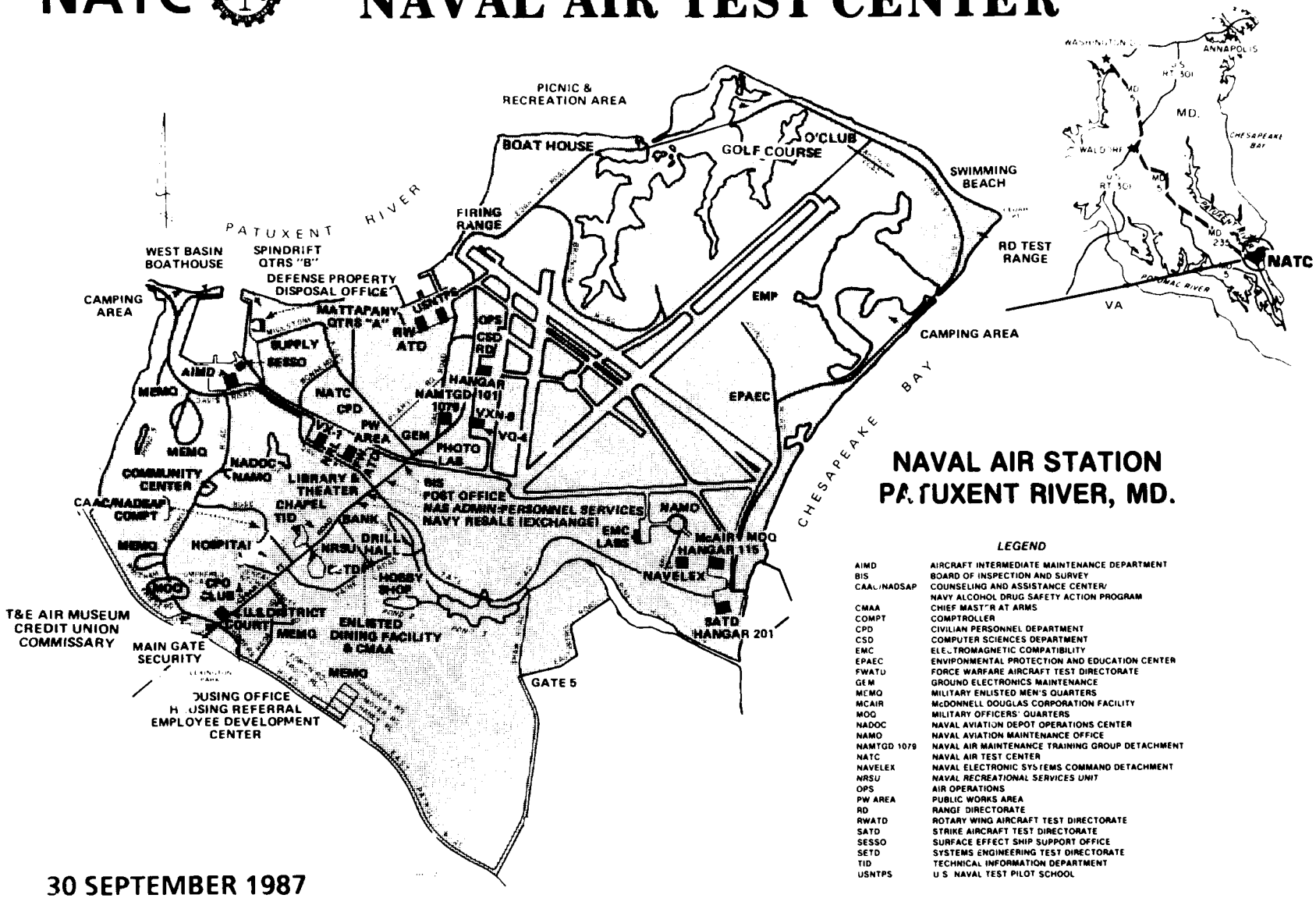
NAVAL AIR TEST CENTER BRIEF

PATUXENT RIVER, MARYLAND

30 SEPTEMBER 1987



NATC NAVAL AIR TEST CENTER



NAVAL AIR STATION PATUXENT RIVER, MD.

LEGEND

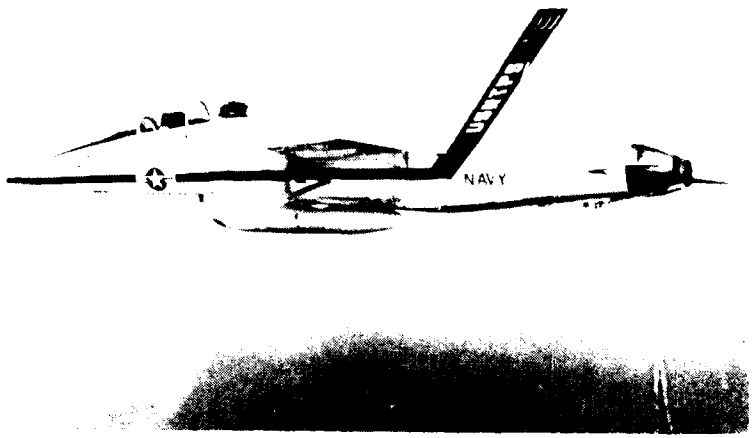
AIMD	AIRCRAFT INTERMEDIATE MAINTENANCE DEPARTMENT
BIS	BOARD OF INSPECTION AND SURVEY
CAAC/NADSAP	COUNSELING AND ASSISTANCE CENTER/ NAVY ALCOHOL DRUG SAFETY ACTION PROGRAM
CMAA	CHIEF MASTER AT ARMS
COMPT	COMPTROLLER
CPD	CIVILIAN PERSONNEL DEPARTMENT
CSD	COMPUTER SCIENCES DEPARTMENT
EMC	ELECTROMAGNETIC COMPATIBILITY
EPAEC	ENVIRONMENTAL PROTECTION AND EDUCATION CENTER
FWATD	FORCE WARFARE AIRCRAFT TEST DIRECTORATE
GEM	GROUND ELECTRONICS MAINTENANCE
MEMQ	MILITARY ENLISTED MEN'S QUARTERS
MCAIR	McDONNELL DOUGLAS CORPORATION FACILITY
MOQ	MILITARY OFFICERS' QUARTERS
NADOC	NAVAL AVIATION DEPOT OPERATIONS CENTER
NAMO	NAVAL AVIATION MAINTENANCE OFFICE
NAMTGD 1079	NAVAL AIR MAINTENANCE TRAINING GROUP DETACHMENT
NATC	NAVAL AIR TEST CENTER
NAVELEX	NAVAL ELECTRONIC SYSTEMS COMMAND DETACHMENT
NRSU	*NAVAL RECREATIONAL SERVICES UNIT*
OPS	AIR OPERATIONS
PW AREA	PUBLIC WORKS AREA
RD	RANGE DIRECTORATE
RWATD	ROTARY WING AIRCRAFT TEST DIRECTORATE
SATD	STRIKE AIRCRAFT TEST DIRECTORATE
SESSO	SURFACE EFFECT SHIP SUPPORT OFFICE
SETD	SYSTEMS ENGINEERING TEST DIRECTORATE
TID	TECHNICAL INFORMATION DEPARTMENT
USNTPS	U S NAVAL TEST PILOT SCHOOL

30 SEPTEMBER 1987

NATC

MISSION

NAVAL AIR TEST CENTER



TO BE THE NAVY'S PRINCIPAL AIRCRAFT WEAPONS SYSTEM TEST AND EVALUATION ACTIVITY THROUGH ACTIVE TEST AND EVALUATION PARTICIPATION IN ALL PHASES OF THE WEAPONS SYSTEM LIFE CYCLE PROCESS. THIS INCLUDES SUPPORTING TECHNOLOGY DEMONSTRATION AND DEVELOPMENT, FULL-SCALE DEVELOPMENT (FSD), PRODUCTION AND FLEET SUPPORT, AND FLEET IN-SERVICE ENGINEERING ASSISTANCE. NAVAIRTESTCEN PROVIDES A PRINCIPAL SITE FOR DEVELOPMENT TEST AND EVALUATION DURING FSD AS ASSIGNED AND PROVIDES, AS DIRECTED, RANGE TECHNICAL ENGINEERING AND/OR BASE SUPPORT FOR NAVY USERS AND OTHER DOD AND GOVERNMENT AGENCIES.

30 SEPTEMBER 1987

NATC

INTRODUCTION

- HISTORY
  - THE NAVAL AIR TEST CENTER (NAVAIRTESTCEN) WAS ESTABLISHED ON 16 JUNE 1945 BY THE SECRETARY OF THE NAVY. NAVAIRTESTCEN WAS AUTHORIZED TO OPERATE UNDER THE NAVY INDUSTRIAL FUND IN FISCAL YEAR 1970. A MAJOR REORGANIZATION IN 1975 CONSOLIDATED AIRCRAFT OF LIKE CHARACTERISTICS. CONTRACTOR DEVELOPMENT OF THE F/A-18A AND YAV-8B INAUGURATED THE PRINCIPAL SITE TESTING CONCEPT IN 1979.
- CHAIN OF COMMAND
  - NAVAIRTESTCEN IS AN ECHELON III COMMAND UNDER THE COMMAND OF THE COMMANDER OF THE NAVAL AIR SYSTEMS COMMAND WHO PROVIDES PRIMARY SUPPORT
- LOCATION
  - NAVAIRTESTCEN IS LOCATED 60 MILES SOUTH, SOUTHEAST OF WASHINGTON, D.C., AT THE CONFLUENCE OF THE PATUXENT RIVER AND THE CHESAPEAKE BAY.
- FUNCTIONS
  - NAVAIRTESTCEN PROVIDES TIMELY TEST AND EVALUATION OF NAVAL AIRCRAFT, THEIR ASSOCIATED WEAPONS SYSTEMS, AND REQUISITE SUPPORT EQUIPMENT. NAVAIRTESTCEN COMPLETES OVER 500 PROJECTS EACH FISCAL YEAR. OVER 50 TENANT ACTIVITIES FACILITATE AN EXCHANGE OF COMPLEMENTARY EFFORTS.
- POPULATION
  - NAVAIRTESTCEN EMPLOYS 6,084 MILITARY, CIVIL SERVICE, AND CONTRACTOR PERSONNEL. THESE PERSONNEL, COMBINED WITH AN ADDITIONAL 5,520 INDIVIDUALS ATTACHED TO TENANT ACTIVITIES, REPRESENT NEARLY HALF OF THE ST. MARY'S COUNTY, MARYLAND, WORKFORCE. NAVAIRTESTCEN IS THE REGION'S LEADING INDUSTRY.
- ORGANIZATION
  - NAVAIRTESTCEN IS ORGANIZED INTO SEVEN MAJOR DIRECTORATES. FOUR ARE DEDICATED TO DIRECT TEST AND EVALUATION ACTIVITIES:
    - STRIKE (VA, VF, VSTOL, ORDNANCE, CARRIER SUITABILITY)
    - ROTARY WING (HELICOPTERS, DYNAMIC INTERFACE)
    - FORCE WARFARE (VP, VS, VQ, VC, VT, VAW)
    - SYSTEMS ENGINEERING (COMMON AIRCRAFT SYSTEMS, EW&R, E^3, C^3)
  - THREE DIRECTORATES PROVIDE SUPPORT:
    - TEST PILOT SCHOOL (EDUCATION)
    - RANGE (RANGE, TELEMETRY, AND INSTRUMENTATION SUPPORT)
    - COMPUTER SCIENCES (SCIENTIFIC AND BUSINESS ADP SUPPORT)
  - THE NAVAL AIR STATION PROVIDES AIRFIELD AND BASE SUPPORT SERVICES.
- REPLACEMENT
  - NAVAIRTESTCEN HAS AN ESTIMATED $957M CLASS II REPLACEMENT VALUE.

30 SEPTEMBER 1987

NATC

FACILITIES
GROUND-BASED TEST LABORATORIES

- **PROPERTY**
  - Land owned/leased — 6,890 acres
  - Buildings
    - RDT&E — 1,365,008 sq ft
    - Administration — 479,604 sq ft
    - Other — 514,579 sq ft
    - Housing/Tenants/etc. — 3,773,578 sq ft
  - ACQUISITION COSTS
    - Real property (class I class II) — $1,078.0 million
    - Equipment (class III and class IV) — $129.0 million
- **E^3 TEST FACILITIES**
  - A copper clad shielded hangar permits testing for Electromagnetic Environmental Effects (E^3) in isolation from external radiation. Specific capabilities include:
    - Electromagnetic Interference (EMI)
    - Electromagnetic Compatibility (EMC)
    - Electrostatic Discharge
  - ADJACENT FACILITIES PERMIT OTHER E^3 TESTS:
    - Electromagnetic Vulnerability (EMV)
    - Vertical/Horizontal Electromagnetic Pulse (EMP)
    - Radiation Hazards (RADHAZ)
  - Tactical aircraft size Anechoic Chamber
- **AIRCRAFT TEST AND EVALUATION FACILITY (ATEF)**
  - The ATEF permits full systems aircraft ground run-ups in a "Hush-House." Special instrumentation and equipment permit fixed-wing aircraft installed systems testing.
    - Engine/intake (crosswind/ingestion)
    - Hydraulics
    - Weight and balance
    - Thrust calibration
    - Environmental
    - Fuel
- **ELECTRICAL AND ELECTRONIC TEST FACILITIES**
  - Airborne systems, subsystems, and component stresses can be duplicated for QPL certification in this laboratory.
    - Vibration (sinusoidal, random)
    - Shock (physical, thermal)
    - Pressure, humidity, temperature
    - Contaminants (sand, dust, brine, fibers, etc.)
    - Constant speed drive stands
- **INERTIAL AND SATELLITE NAVIGATION TEST LABORATORY**
- **MANNED FLIGHT SIMULATOR FACILITY**
  - *Simulation of imbedded computer systems*
- **SHIP GROUND STATION**
  - Helo/ship system test facility
- **ENGINE TEST STANDS**
  - Engine test stands permit the testing of engines and related subsystems in isolation from the aircraft.
- **ORDNANCE TEST FACILITIES**
  - Ordnance systems compatibility can be tested in a controlled environment.
    - Gun Firing Facility
    - Rocket Launcher and Bomb Rack Test Facility
    - Ordnance Electric Test Laboratory
    - Moment of Inertia Test Facility
    - Weapon Separation and Ballistics Facility
    - Stores Management Test Facility

30 SEPTEMBER 1987

NATC

FACILITIES
FLIGHT SUPPORT

- **AIRFIELD**
  - NAVAIRTESTCEN operates from an all-weather airfield available 365 days a year. 518 paved acres of runways, taxiways, and aprons provide excellent flight facilities.
    - Runway 6-24 11,800 feet
    - Runway 14-32 9,700 feet (with catapult and arresting gear)
    - Runway 2-20 6,400 feet
    - VSTOL landing pad
    - Helicopter operating areas
  - The airfield is surrounded on three sides by water. Overwater approaches significantly reduce the air installation impact on the surrounding community.

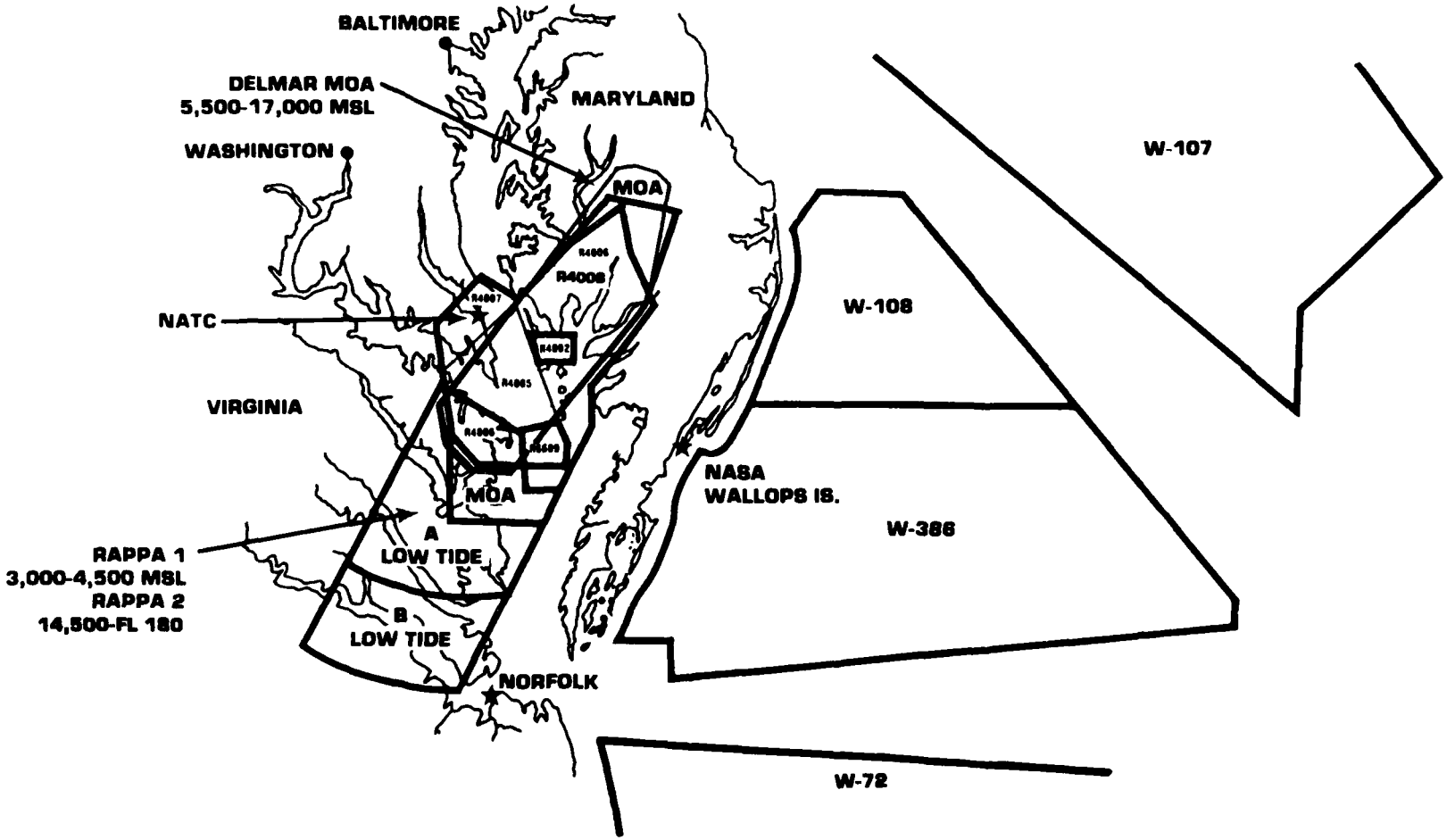
- **AIRCRAFT STABLE**
  - NAVAIRTESTCEN maintains an average of 120 aircraft representing 30 different models in 50 differing configurations. These fighter, attack, trainer, patrol, early warning, electronic warfare, and rotary wing aircraft serve as flying testbed, chase, target, tanker, and search and rescue assets. In addition to these test and evaluation dedicated aircraft, the airfield accommodates over 40 fleet aircraft. The entire complex can support in excess of 200 air vehicles.

- **AIR OPERATIONS**
  - Patuxent River Departure and Arrival Control has been delegated by FAA to provide control for 28 airfields in a 4,600-square-mile region of Southern Maryland. Eight of these airports have published instrument approaches and 23 are civilian-operated. NAVAIRTESTCEN has direct cognizance of three Chesapeake Bay restricted areas and two Military Operating Areas (MOA).
    - R-4005
    - R-4006
    - R-4007
    - R-4008
    - Rappa MOA
    - Delmar MOA
  - Other areas are available on a shared basis
    - R-4002
    - R-6609
    - W-386 and W-108
    - Low tide A & B
  - Combined inland and offshore operating areas available to NAVAIRTESTCEN exceeds 50,000 square miles. Transit to and from offshore operating areas is available via low altitude IFR routing or VFR flight following. The NASA Wallops Airfield has been configured as a primary divert and support facility for offshore operations.

- **AIRCRAFT SUPPORT**
  - NAVAIRTESTCEN operates a complete Aircraft Intermediate Maintenance Department and supports Fleet and RDT&E organizational level maintenance activities in 18 hangar bays. The Supply Department is configured to meet unusual demands.

30 SEPTEMBER 1987

NATC SPECIAL USE AIRSPACE



30 SEPTEMBER 1987

NATC

FACILITIES

FLIGHT SYSTEMS TEST LABORATORIES

- FLIGHT INSTRUMENTATION
  - NAVAIRTESTCEN designs, fabricates, calibrates, tests, and installs a wide variety of specialized airborne test instrumentation. The airborne instrumentation includes transducers, serial digital interfaces, signal processors, high-speed cameras, tape recorders, telemetry transmitters, and automated calibration and checkout equipment. A ready pool of standard airborne instrumentation, a mechanical design and fabrication facility, and an on-site calibration laboratory traceable to the National Bureau of Standards facilitate this process. Precise data from the airborne sensors may be recorded onboard the flying aircraft or down-linked to ground tracking stations at Patuxent River on NASA Wallops.
- REAL-TIME TELEMETRY PROCESSING SYSTEM (RTPS)
  - The RTPS receives up to 512 independent data measurements from each of four aircraft operating simultaneously. Each of these four channels samples data measurements at rates of up to 50K times per second. Each channel can operate from airborne recorded tapes or telemetered data at a receiving rate of 1.2M bits per second. These data are converted to corrected engineering units, subjected to safety-of-flight checks, and displayed in real-time to project engineers on one of four separate Project Engineering Stations (PES). The following real-time data outputs are provided:
    - Computer-Driven Graphics CRT with Hard Copy Unit
    - Critical Parameter Numerical Readout
    - Communications Network (Aircraft, NASA, Chesapeake Test Range (CTR), Air Ops)
    - Strip Chart Recorders (32 channels)
    - Audible Limit Alerts
    - 160-Item Digital Flight Control Status Display
  - Displays, output formats, and scaling are called or modified through a specialized, easily operated keypad. A fifth channel provides higher rates, multiple serial digital streams per vehicle, and expanded display capacity and serves as prototype for a new telemetry system now being procured.
- CHESAPEAKE TEST RANGE (CTR)
  - While RTPS gives insight to what is happening inside flying aircraft, the CTR provides exact space positioning information on the aircraft. These three-axis dynamic tracking data can be fed directly to the RTPS through range computers. CTR tracking capabilities include:
    - 20 Radars (CW, tracking, search)
    - 6 Cinetheodolites along a 10-mile shoreline
    - Automatic laser tracking van
    - NASA Wallops tracking radar and TM data via data link
  - Tracking and surveillance data are computed and displayed in real-time to range flight controllers on interactive graphic color CRT's and a large screen projection. CCTV flight following is displayed on monitors and recorded at the range control center. CTR assists in shipboard and Automatic Carrier Landing System (ACLS) certifications, provides meteorological data, and maintains a wide variety of fixed and mobile land and sea targets.
- ANTENNA AND AVIONICS FLIGHT TEST FACILITY
  - This facility provides a comprehensive capability to evaluate aircraft avionics systems including secure and nonsecure communications, IFF, and radar systems. The Antenna Testing Laboratory Automated System (ATLAS) is a key component that provides unique capability to accurately measure all aircraft antenna patterns in flight. The system's versatility is demonstrated by its capability to fully evaluate a wide range of antennas including omni, narrow beam, rotating, steerable, and adaptive controlled antennas.
- CATAPULT AND ARRESTING GEAR
  - NAVAIRTESTCEN operates a ground-based TC-7 steam catapult and two MK-7 arresting gear to test an aircraft's carrier suitability under controlled conditions. The arresting gear works in conjunction with visual landing aid and ACLS.
- NAVAIRTESTCEN operates U. S. Naval Test Pilot School.

30 SEPTEMBER 1987

NATC

FACILITIES

AIRCRAFT SYSTEMS TEST LABORATORIES

- **TACTICAL AVIONICS AND SOFTWARE TEST AND EVALUATION FACILITY (TASTEF) / MANNED FLIGHT SIMULATOR (MFS)**
  - This laboratory utilizes six PDP-11 computers and two VAX 11/780 computers to simulate the airborne environment for weapons systems, flight systems, and other avionics for selective testing of avionics and software. Full digital interface with the 1553A Multiplex Bus and NTDS permits maximum flexibility. Two engineers' stations and a generic cockpit provide operator inputs from numerous sources.
    - Stick
    - Throttle
    - Programmable Switches
    - Voice
    - Heads-Down Programmable Cockpit Displays
  - Cockpit and out-the-window displays may be replicated on graphics CRT's which include three-dimensional capability and microprogrammability. An extensive software library permits a wide range of realistic systems simulations.
    - Nonlinear Aerodynamics (6 degrees of freedom F-14, F-4S, AV-8B, Generic Aircraft)
    - Radar and Target Models
    - Communication System Models
    - Environmental Conditions
    - Inertial Navigation
    - Engine Models
    - Air Data Computer
    - Full Range of Support Software
    - Stores Management
  - The laboratory is rapidly reconfigurable and will permit multiple simultaneous real-time simulations. This flexibility provides a rapid and economical tool to aid in the test and evaluation of modern complex integrated aircraft weapons systems.

- **ACOUSTIC TEST FACILITY (ATF)**
  - This laboratory generates desired undersea acoustic phenomena. These acoustic signals may then be fed to an aircraft on the ground by cable or transmitted to instrumented aircraft in flight. In this manner, ASW systems test and evaluation can be conducted against known conditions without the expense of obtaining at-sea assets and conditions. Extension to the C^3I environment is possible using the NAVELEXDETPAX Tactical Support Center and ASWOC assets. Subsystems under test may also be isolated in the laboratory for specific performance measurements in a controlled environment.

- **ELECTRONIC WARFARE INTEGRATED TEST SYSTEMS LABORATORY (EWISTL)**
  - This laboratory provides a dense, realistic, and dynamic signal environment for the test and evaluation of EW systems installed in aircraft. System performance is evaluated by the automatic correlation of EW system data and the signal environment. Integrated tests permit the evaluation of installation factors on system performance. A carrier-based aircraft can be accommodated in the Anechoic Chamber which provides a free space environment for testing.

- **INTEGRATED LABORATORY SYSTEM**
  - This system links mission system laboratories via four 300 MHz bandwidth cables to a common scientific data base. These laboratories include:
    - TASTEF
    - EWISTL
    - ATF
    - E^3 LABS
  - Simultaneously, flight systems test laboratories are interconnected to the same data base for data storage and real-time computation in overflow situations.
    - RTPS
    - CTR
  - AMDAHL 470V7 and DEC 11/34, 1160, and VAX computers permit both large-scale data processing and massive storage capacity (billions of bytes). Using this capability, actual flight data may be compared with simulation expectations.

30 SEPTEMBER 1987

NATC

PROGRAM WORK

- AIRCRAFT MISSION SYSTEMS LIFE CYCLE TEST AND EVALUATION
  - Overall integrated system
  - Technical performance
  - Aircraft mission effectiveness
    - Antisubmarine warfare
    - Strike (fighter/attack)
    - Rotary wing
    - Electronic warfare
    - Logistics
    - Reconnaissance
    - Training
    - VSTOL

- AIRCRAFT SYSTEMS TEST AND EVALUATION
  - Airframe
  - Structural
  - Flight control
  - Electrical
  - Environmental control
  - Fuel
  - Hydraulic
  - Mechanical
  - Pneumatic
  - Propulsion
  - Gun
  - Life support
  - Related ground support systems

- AIRCRAFT MISSION EQUIPMENT TEST AND EVALUATION
  - Sensors
  - Data Storage and Processing Computers
  - Software involving aircraft control, maintenance, and operations
  - Displays
  - Communications equipment
  - Navigation systems
  - Identification systems
  - Electronic countermeasures systems
  - Fire control systems/stores management
  - Related ground support interfaces and equipments

- AIRCRAFT FLIGHT CHARACTERISTICS TEST AND EVALUATION
  - Flying qualities
  - Performance
  - Cruise control
  - Carrier suitability
  - Weapon/store carriage
  - Landing aids and systems
  - Electromagnetic interference/compatibility
  - Training
  - Pilot/aircrew checkout criteria
  - Aircraft and aircraft systems simulators
  - Human factors and safety
  - Carrier/ship launch and recovery criteria
  - Weapon/store separation envelopes
  - Ship/shore landing aid systems certification

30 SEPTEMBER 1987

NATC

PROGRAM WORK
(CONTINUED)

- AIRCRAFT MAINTENANCE AND SUPPORT TEST AND EVALUATION
  - Reliability
  - Maintainability
  - Integrated logistics support
  - Ground suport equipment
- LEAD FIELD ACTIVITY
  - Monitor contractor DT&E of new aircraft or significant modifications
  - Witnessing contractor demonstrations
  - Test authority
  - DT-II
  - Navy Technical Evaluations (NTE's) on aircraft
  - Board of Inspection and Survey aircraft trials
- TESTING TECHNOLOGY
  - Conduct training in test disciplines
    - Pilots
    - Naval flight officers
    - Civilian engineers
    - Selected foreign nationals
  - Development of new test techniques
    - New flight or ground/ship testing
    - Test instrumentation
    - Simulation/stimulation T&E methods
- LEAD LABORATORY
  - Airborne electrical components
  - Ground support equipment
  - Navy QPL product certification
- TECHNICAL AND OPERATIONAL SUPPORT
  - Instrumentation pool
    - Design
    - Fabrication/calibration
    - Installation/maintenance
  - Telemetry and data links
  - Range services (tracking, EW, targets)
  - Aircraft system test laboratories
  - Ground system test laboratories
  - Aircraft intermediate maintenance
  - Supply
  - Chase, target, and tanker aircraft
  - Air control
- FACILITIES, RESOURCES, AND SUPPORT
  - Armory
  - Landing aid sites
  - Search and rescue aircraft and boats
  - Administrative aircraft and services
  - Airfield and air terminal
  - Synergistic tenant activities
    - Naval Aviation Depot Operations Center
    - Naval Aviation Maintenance Office
    - Naval Research Laboratory
    - Naval Surface Weapons Center
    - VXN-8 • VX-1 • VQ-4
    - Naval Electronic Systems Engineering Activity
    - NAVELEXDETPAX
    - BIS

30 SEPTEMBER 1987

NATC

ACCOMPLISHMENTS

- SH-60F CV HELO PROGRAM
  - Participated in DT-IIB contractor development testing of new Automatic Flight Control System (AFCS) software conducted at Sikorsky Aircraft, Stratford, Ct. Witness DT-IID demonstrations of LOT I SH-60F helicopters at West Palm Beach, Fl. and Patuxent River, Md.
  - Conducted DT-IIC testing of the AFCS at NAVAIRTESTCEN, in the VACAPES operating areas and the Atlantic Undersea Test and Evaluation Center (AUTEC). Started DT-IIE technical evaluation on 27 June 1987 at Patuxent River.
  - Participated in numerous hardware and software design working groups, Reliability Maintainability (R&M) and logistic reviews, Navy training planning conferences, system safety reviews, and trainer/simulators planning meetings.
  - Conducted electromagnetic compatibility; AFCS, sonar systems, and engine performance; R&M; and new avionics, armament, and fuel systems tests.

- V-22 PROGRAM
  - Continued extensive participation in critical design reviews, technical working groups, and other interface meetings with NAVAIRSYSCOM and contractors in Full Scale Development (FSD).
  - Signed a Memoradum of Agreement with the Air Force and Army establishing a Multi-Service Test Team for V-22 tests and evaluation.
  - Signed a Memorandum of Agreement with Bell-Boeing establishing the degree of government participation in the contractor's FSD program. This agreement will be supplemented by Host-Tenant Support Agreements for each of the three principal test sites and Integrated Test Plans in numerous technical areas.
  - Obtained CNO approval for NATC Multi-Service Test Team detachments at Bell-Boeing to support the NAVAIRTESTCEN participation at those sites.
  - Identified billets, numbers, unit identification code, and table of organization requirements for military FSD support personnel.
  - Signed a contract to upgrade the NATC Manned Flight Simulator (MFS) to near-high fidelity to accommodate engineering studies and train government test pilots for the V-22 program.
  - Initiated facilities construction/rehabilitation design to support V-22 T&E activity at NAVAIRTESTCEN.
  - Continued development of program specific hardware and software in support of NATC's V-22 Government Test Pilot Trainer (GTPT). The Ready for Training (RFT) date is scheduled for January 1989.

- SH-60B LAMPS MKII PROGRAM
  - Continued T&E of airframe/avionics improvements, the Air Operational Program (AOP), and the Ship Processor Operational Program (SPOP).
  - Continued T&E support of simulators and operational flight trainers, intratheater positioning, flight support for SPOP at Rokonkoma, NY; Morristown, NJ; and FCDSSA Dam Neck, VA.
  - Supported post-shakedown availability and weapons systems operational tests for SH-60B capable ships.
  - Supported pre-planned product improvement (P^3I) for Penguin Missile/MK50 Torpedo, the 99 Channel Sonobuoy Receiver, and the Global Positioning System (GPS).
  - Continued assistance to the software support activity.
  - Completed T&E efforts on the Penguin Missile Lanyard, Dynamic Interface (CG-49), Blade Fold System, MK-50 torpedo separations, intratheater positioning, mid East Force MODS, electrical power transients, and the ALQ-142 ESM.
  - Developmental certifications (FFG-8, DD-963) at NAVAIRTESTCEN including ARC-182 Radio (pre-production), fixed MAD (foreign weapons evaluation), and GE T-700-401C/RTM-322 engine.

30 SEPTEMBER 1987

NATC

ACCOMPLISHMENTS
(CONTINUED)

- MARK XV PROGRAM
  - Conducted U. S. Mark interoperability, Army Hawk plug compatibility, radar mode co-site interference on the A-6 and F-18, and Mark XV interference to ATCRBS and TACAN tests.
  - Conducted core flights tests, consisting of 29 missions totalling 184.4 flight hours.
  - Drafted DT&E portion of FSD TEMP.
  - Designed and fabricated flight test instrumentation.
  - Performed vulnerability assessment of ADM'S using DVAL susceptibility module.
  - Conducted planning for NATO interoperability and FY 88 U. K. radar mode flight testing.
- MANNED FLIGHT SIMULATOR (MFS)
  - Integrated a General Electric Compuscene IV Computer Image Generation (CIG) system into the MFS. The CIG will generate high resolution, real-time visual databases for display at MFS and Air Combat Environment Test and Evaluation Facility (ACETEF) simulation stations.
  - Entered various phases of the contracting process for procurement of a wide field of view motion base projection system, a 40' dome projection system, and combat environment control software in support of MFS, and ACETEF programmed and planned tasking.
  - Completed construction of two medium fidelity visual simulation stations within the MFS.
- JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEMS (JTIDS)
  - Continued monitoring Singer-Kearfott Navy Time Division Mutiple Access (TDMA) terminal development.
  - Continued Data Reformat and Data Analysis (DR&DA) systems for the E-2C and F-14D aircraft. Developed Navy JTIDS TDMA Data Extraction and Data Reduction format standard (DE&DR).
  - Continued develpment of the Data Link Vulnerability (DLV) anti-jam margin hardware.
  - Participated in TDMA Terminal Network Implementation and Initialization working groups.
  - Participated in R&M demonstrations of the AF Class Two TDMA terminals.
- E-6A PROGRAM
  - Commenced joint Boeing/Navy E-6A flight test program at the contractor's Seattle facility on 1 June 1987. Completed 110 flight test hours.
  - Completed flight training and qualification of NATC's first flight crew.
  - Completed technical and operational evaluation for the Enhanced Verdin System (EVS), paving the way for inclusion of EVS in the baseline E-6A configuration.
  - Monitored the development of the High Power Transmit System (HPTS) by Rockwell for the E-6A Block I upgrade.
  - Sponsored the kickoff meeting for the Block II mission system upgrades due in post 1990.
- ADVANCED SELF PROTECTION JAMMER (ASPJ)
  - Conducted four and one-half months of developmental flight testing on the F/A-18A for PMA-272. Completed June 1987.
  - Completed on-site portion of technical evaluation including EW suite intergration tests in the Anechoic Chamber at NAVAIRTESTCEN in October 1987.
  - Started final developmental flight test phase at NWC in October 1987 as a prelude to jammer effectiveness test portion of technical evaluation to be conducted late 1987 or early 1988.
  - Scheduled technical evaluation of ASPJ POD on AV-8B for June 1988.
  - Scheduled follow-on technical evaluation of ASPJ on F/A-18C for October 1988.

NATC

ACCOMPLISHMENTS
(CONTINUED)

- EA-6B PROGRAM
  - Established ADVCAP support requirements for ground and flight test phases scheduled to begin at NAVAIRTESTCEN in October 1989.
  - Completed numerous small support programs evaluating changes and improvements to existing models.

- CLOSED LOOP FACILITY
  - Fabricated and evaluated missile control and test conductor consoles.
  - Continued development of the missile hardware and software at NWC.
  - Accepted new building and installation of furniture. The computer equipment is underway.
  - Scheduled formal acceptance tests of radar and target simulator for mid-December 1987.
  - Scheduled the radar, target simulator, missile, and instrumentation integrated for January 1988.
  - Released the RFP to limited competition for second threat simulation. Contract awards anticipated in March 1988.
  - Established requirements for a new background environment generator and began development of a specification.

- VQ PROGRAMS
  - Performed software tests at NSWC, Dahlgren, VA, during EP-3E CILOP software development.
  - Participated in preliminary and critical design review for EP-3E CILOP aircraft.
  - Established fleet procedures for RADOME transmissivity testing.
  - Developed a consolidated test plan outline to coordinate phased testing at an integrated test facility, Naval Avionics Center, Indianapolis, IN; at the conversion contractor, Lockheed, Greenville, NC; and at NAVAIRTESTCEN.
  - Developed a communications simulator to support communication intercept receiver testing.
  - Completed technical evaluation of a fleet electronic warfare support group EC-24A aircraft.
  - Participated in the draft proposal for ES-3A modification program.
  - Conducted critical path analysis of the ES-3A program to identify hard points that effect the three year proposal for the ES-3A modification program.
  - Provided test asset coordination for DT phases (A/B/C) of the Battle Group Passive Horizon Extension System (BGPHES).
  - Developed a phased test plan for ES-3A program three year schedule, coordination tests at an integrated test facility, contractor site, NAVAIRTESTCEN, and during operational evaluation.

- A-6 PROGRAM
  - Participated in V&V of E-240 software for SWIP. Conducted SWIP technical evaluation.
  - Conducted evaluation of Tactical Air Director System and Ground Proximity Warning System.
  - Participated in PDRs and CDRs of A-6F and re-wing program.
  - Developed joint contractor/Navy test plan for A-6F FSD Conducted initial A-6F aero-propulsion flight tests.
  - Conducted joint contractor/Navy baseline tests for re-wing program.
  - Conducted analysis and prepared for flight test of Things Falling Off Aircraft Program.

NATC

ACCOMPLISHMENTS
(CONTINUED)

- P-3 SERIES AIRCRAFT PROGRAMS
  - UPDATE III
    - Performed various hardware and software validation tests.
    - Developed simulation test lab to CDR stage.
  - UPDATE IV
    - Flight tested ALR-77 ESM.
    - Participated in proposal evaluation, source selection board and design advisory panels.
    - Began monitor of Boeing.
    - Completed and awarded contract for Patrol Avionics Test Lab (PATL).
  - Survivability and vulnerability evaluations and integrations including AAR-47 Missile Warning Receiver, fuel inerting, Outlaw Hunter and AIM-9.
  - Continued support of project Beartrap.
  - Performed Software Support Activity (SSA) for P-3B MOD and P-3B trainer. Released Operational Flight Program (OFP) 19.01.
  - Conducted T&E of P-3 product improvements including:
    - Installed and evaluated Sperry and 3M Lightning Detection Systems.
    - Evaluated replacement of digital fuel gauges
    - Investigated ECS waterspray system problems reported by the fleet
    - Flight tested digital MAD system
    - Began planning for spinning antenna tests
    - ALR-66 ESM.
    - Evaluated updated signature library
    - Participated in design reviews for on line integration.
    - Provided Navy acceptance of fleet installations and lessons learned training and support to the fleet on the APS-137 ISAR.
    - Completed evaluation of revised AQA-7 broadband system and recommend operational evaluation.
  - Long range air ASW capable aircraft
    - Participated in SPEC, RFI, and RFP development
    - Provided TEMP and BIS inputs.
- T/AV-8B PROGRAM
  - Conducted flight tests to expand shipboard OPS to include AWLS and night operation clearances.
  - Performed weapon separation tests to update TACMANUAL for parent station loads.
  - Executed flight tests of Omnibus IV mission computer and SMS software which enhanced the weapon delivery system.
  - Conducted night atack evaluations including night vision goggles, NAV FLIR WIDE FOV HUD, and digital moving map.
  - Issued TAV-8B FSD program fleet clearnaces.
  - Performed digital engine control development flight tests with fleet clearances.
- F-14 PROGRAM
  - Conducted the first flight of the F-14A (plus).
  - Performed F-14A fuel system flight tests for the "Bugout" problem.
  - Improved the flight fidelity operator trainer.
  - Implemented the F-14A/F-14A (Plus) EW suite evaluation.
  - Improved the ACLS waveguide evaluation.
  - Conducted the F-14A (plus) carrier suitability and shipboard compatibility tests.
  - Performed the night vision goggle compatibility tests on a locally modified F-14A cockpit.
  - Completed the F-14D pilot station integration and cockpit hardware for local simulation tests in ACETEF.

NATC

ACCOMPLISHMENTS
(CONTINUED)

- F/A-18 PROGRAM
  - Conducted landing gear loads (trunions, levers, and coiled springs).
  - Tested inverted fuel and handling qualifications for the Blue Angels.
  - Degraded flight modes.
  - Performed ECS baseline evaluation.
  - Conducted multiple CV/ACLS certifications and verifications.
  - Modified the afterburner flameholder.
  - NACES FIT evaluation.

- T-45A PROGRAM
  - Conducted host tenant agreement negotiations with the contractor.
  - Performed a facilities review for FSD principal site testing at NAVAIRTESTCEN.
  - Reviewed proposed hybird digital cockpit.
  - Coordinated test planning with the contractor for combined FSD tests.
  - Participated in the spin chute design and first flight clearance reviews.
  - Evaluated the high lift development.

- X-31A PROGRAM
  - Established the NAVAIR Advanced Development Projects Office (ADPO-51) and the NAVAIR Class Desk (AIR-5114).
  - Negotiated and awarded the contract to complete preliminary and detailed designs.
  - Completed Preliminary Design Review (PDR)
  - Established team and acquisition procedures for government-furnished equipment.

- REALNIGHT (NAVY NIGHT ATTACK TESTBED) PROGRAM
  - Evaluated A-6A testbed night attack and systems for exploitation of advanced technology preceding production aircraft testing.
  - Outfitted A-6E testbed with two Wide Field of View (WFOV) Head Up Displays (HUDS) that present Navigation FLIR (NAVFLIR) imagery and flight information symbology; a digital color moving map; NAVFLIR imagery or scan converted radar video; Night Vision Goggle (NVG) compatible cockpit lighting; high transmissivity polycarbonate/acrylic windscreens; and helmet mounted NVG's for both crewmen (Cat Eyes MK IIIC NVG).
  - Flew 100 test flight hours including NAVAIRTESTCEN local low-level routes with detachments to NAVSTRKWRFCEN, Fallon, Nv. and VX-5, China lake, Ca.
  - Future night attack component testing includes Terrain Referenced Navigation (TRN), CO2 laser cable warning devices, enhanced NAVFLIR technologies, and HUD/targeting FLIR weapon system integration.

- VANDAL PROGRAM
  - Participated in two training exercises launching three high-altitude supersonic VANDAL targets against Atlantic Fleet units.
  - Conducted three test and evaluation exercises launching six low altitude (50 ft) supersonic targets for PMS-400 against AEGIS ships.
  - Provided a contract for helicopter and fixed wing aircraft to support the range clearance effort, eliminating the previous requirement for fleet helicopters.

NATC

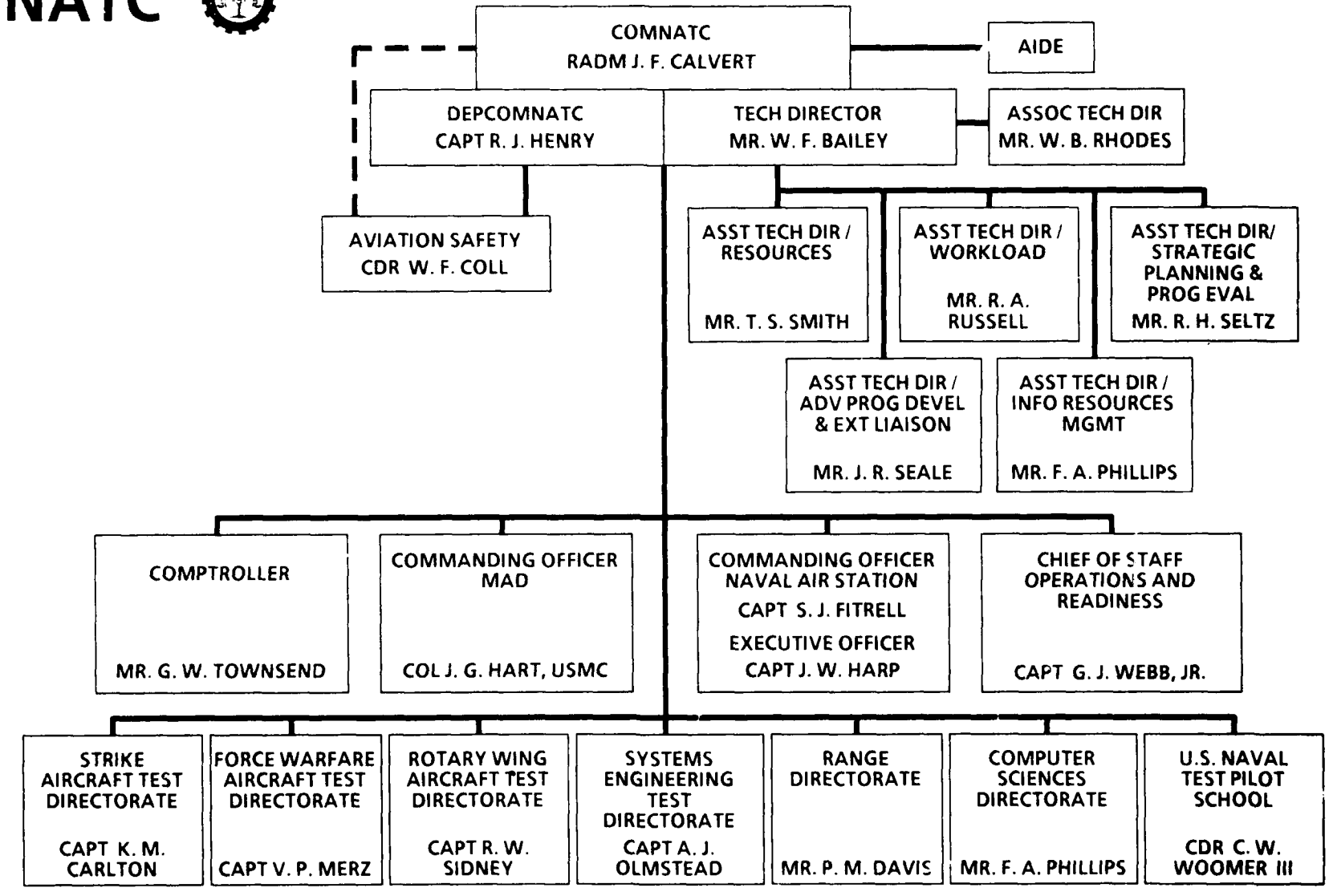
ACCOMPLISHMENTS
(CONTINUED)

- TACTICAL AIRCREW COMBAT TRAINING SYSTEM
  - Designed and developed a countermeasures employment detection subsystem for tactical aircraft. This allows the Tactical Aircrew Combat Training System (TACTS) to display and record the deployment and/or use of the ECM systems in the strike/attack mission. NAVAIRTESTCEN is developing the simulations required to integrate this capability with the TACTS. This is a multiyear effort which is scheduled to be completed in FY89.
  - Installed and tested the integration of the TACTS pod on the CH-46E, CH-53E, and the UH-1N.
  - Developed the specifications and procurement packages required for the sole source procurment of the TACTS ranges at Cherry Point, Charleston, and Key West. Participated in the proposal evaluation of the Cubic proposals and the first design review for these ranges.
  - Developed a plan, in conjunction with MAWTS-2, MCAS Yuma, to layout the Yuma range and for use of the building to house the 36 aircraft TACTS. Additionally, developed the test and evaluation plan for the tactical training ranges. This was developed for Yuma, but forms the basis for all future tactical training range T&E. Designed and developed the communications required to integrate the Yuma range.
  - Planned and conducted requirements analyses and systems engineering to commence the design and development of a deployed At-Sea Combat Training System. Worked with AIRLANT and AIRPAC in conducting the operational analysis which will support the systems requirement document.
  - Spearheaded the Navy's effort in development of the GPS for use in the tactical training range. Although the executive service is the Air Force, NAVAIRTESTCEN participated in meetings and design reviews required to support the eventual inclusion of GPS to support the training mission.

- TOMAHAWK CRUISE MISSILE PROGRAM
  - Conducted ten launches of the TOMAHAWK cruise missile. Six of these were TOMAHAWK Land Attach Missiles (TLAM). The remaining for missiles were TOMAHAWK Antiship Missiles (TASM) variants. One of the TLAM missions was the first launch of the highly accurate conventional warhead TLAM-C on the east coast. Additionally, the first east coast test of the submarine Vertical Launching System was conducted during a TASM mission.
  - Continued development of both the northern Maine route and NASA Wallops Flight Facility for future use in the TOMAHAWK Operational Test Launch (OTL) Program. NAVAIRTESTCEN's UC-880 aircraft continued to provide valuable support to the east coast OTL Program.

NATC

NAVAL AIR TEST CENTER ORGANIZATION



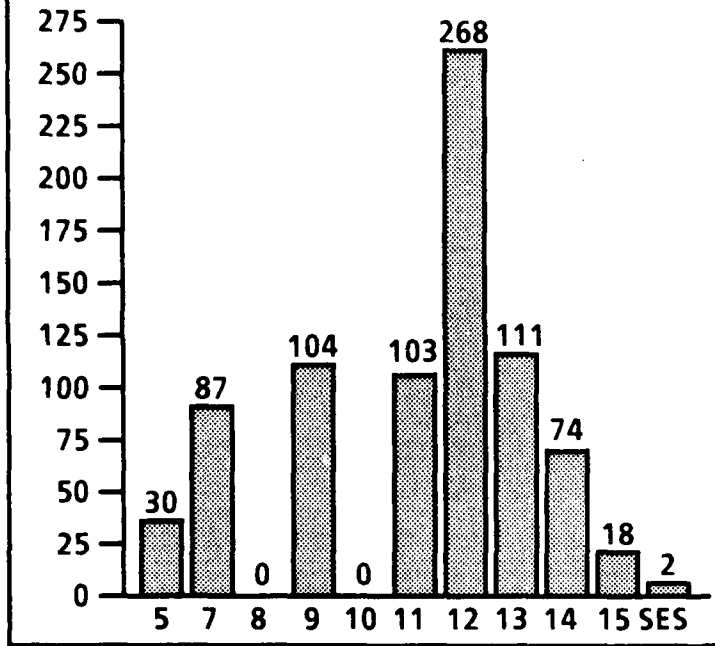
30 SEPTEMBER 1987

NATC

PERSONNEL DATA

ON BOARD	MILITARY	CIVILIAN	FTP	TPTI*	UNGRADED (FT)	GRADED (FTP)	SES
	1,463	2,607	2,516	91	362	2,152	2

SCIENTISTS AND ENGINEERS BY GRADE



FIRE, SECURITY, CLERICAL	583
ADMINISTRATIVE	427 **
TECHNICIANS	347
SCIENTISTS AND ENGINEERS	797

ELECTRONIC ENGINEER	327
AEROSPACE ENGINEER	202
GENERAL ENGINEER	87
MATHEMATICIAN	36
MECHANICAL ENGINEER	50
ELECTRICAL ENGINEER	17
CIVIL ENGINEER	3
BIOLOGIST	4
OPERATIONS RESEARCH	8
OTHER (ARCHITECT, ENGINEERING PSYCHOLOGIST, COMPUTER SCIENTIST)	51

DEGREES - PROFESSIONAL PERSONNEL

	PhD	MS/MA	BS/BA
SCIENTISTS & ENGRS	5	127	651

CIVILIAN CEILING (FTP) 2,441

MILITARY ALLOWANCE:
OFFICER .....187 ENLISTED 1,446

* TEMPORARY, PART-TIME, INTERMITTENT

** CLERICAL NOT INCLUDED. ONBOARD CIVILIAN INCLUDES 4 STUDENT TRAINEES

30 SEPTEMBER 1987

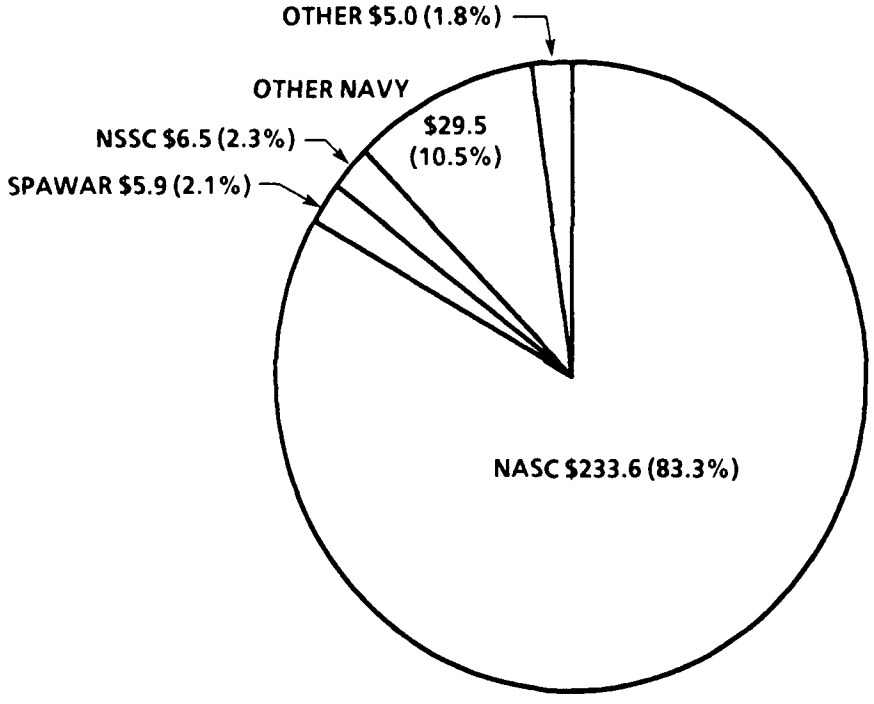
NATC

NOR

SOURCE OF FUNDS

NEW ORDERS RECEIVED
($ IN MILLIONS)

FY87
ACTUAL $280.5



NASC – NAVAL AIR SYSTEMS COMMAND
SPAWAR – NAVAL SPACE WARFARE SYSTEMS COMMAND
NSSC – NAVAL SEA SYSTEMS COMMAND

30 SEPTEMBER 1987

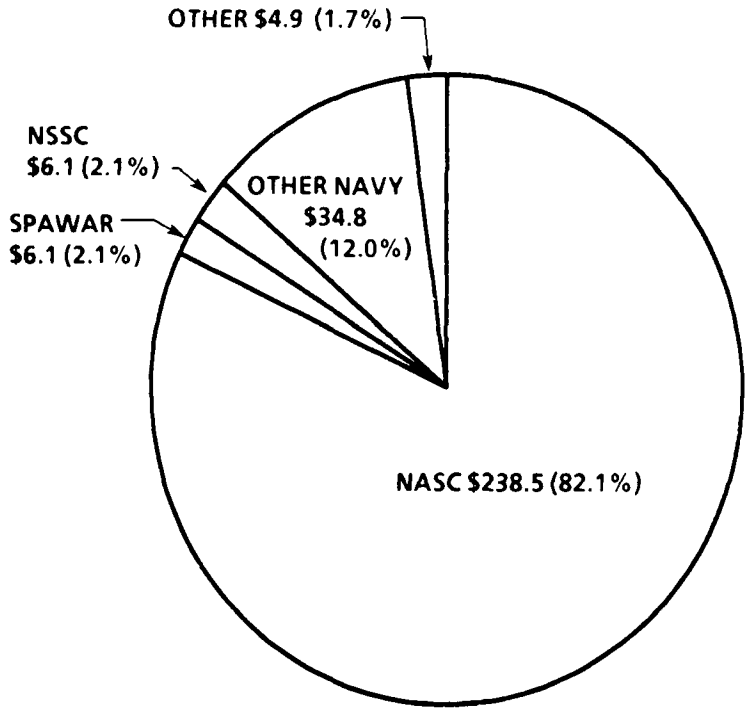
NATC

NOR

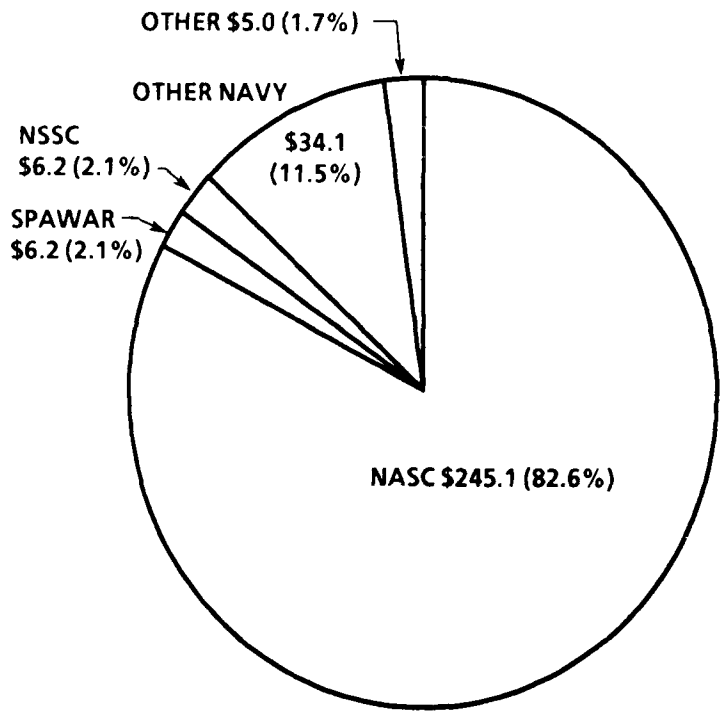
SOURCE OF FUNDS

NEW ORDERS RECEIVED
($ IN MILLIONS)

FY88
PLANNED $290.4



FY89
PLANNED $296.6



NASC – NAVAL AIR SYSTEMS COMMAND
SPAWAR – NAVAL SPACE WARFARE SYSTEMS COMMAND
NSSC – NAVAL SEA SYSTEMS COMMAND

30 SEPTEMBER 1987

NATC

NOR

FUNDS BY TYPE

NEW ORDERS RECEIVED
($ IN MILLIONS)

	FY87		FY88		FY89	
	ACTUAL	PERCENT	PLANNED	PERCENT	PLANNED	PERCENT
RDT&E.N.						
6.1 RESEARCH	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
6.2 EXPLORATORY DEVELOPMENT	0.1	0.0	0.1	0.0	0.1	0.0
6.3 ADVANCED DEVELOPMENT	8.4	3.0	8.5	3.0	8.6	2.9
6.4 ENGINEERING DEVELOPMENT	28.0	10.0	28.4	9.8	28.5	9.6
6.5 MANAGEMENT & SUPPORT	88.0	31.4	89.2	30.7	89.5	30.2
6.6 OPERATIONAL SYSTEMS DEVELOPMENT	13.2	4.7	13.3	4.6	13.3	4.5
SUBTOTAL	$137.7	49.1%	$139.5	48.1%	$140.0	47.2%
PROCUREMENT (OPN, WPN, SCN, APN, PAMN, & FMS FUNDS)	54.0	19.2	45.4	15.6	59.9	20.2
O&MN	68.8	24.5	75.8	26.1	73.6	24.8
OTHER (RDT&E FUNDS)	7.8	2.8	11.8	4.1	9.0	3.0
OTHER	12.2	4.4	17.9	6.1	14.1	4.8
TOTAL	$280.5	100.0%	$290.4	100.0%	$296.6	100.0%

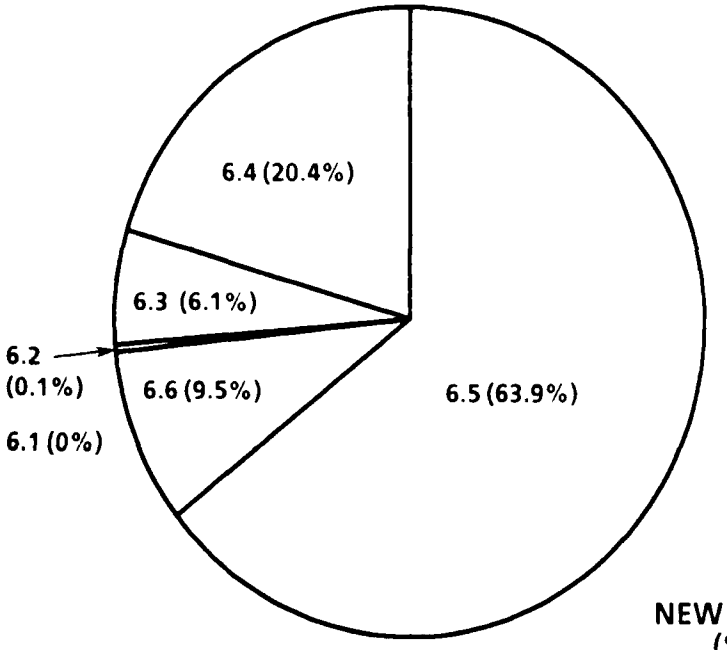
30 SEPTEMBER 1987

NOR

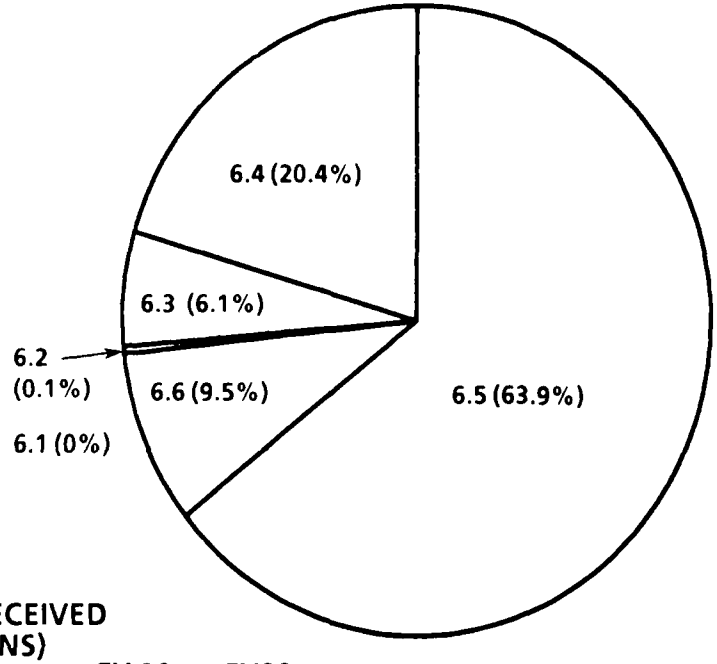
NATC

RDT&E FUNDS BY CATEGORY

FY88



FY89



NEW ORDERS RECEIVED
($ IN MILLIONS)

	FY 88	FY89
6.1 RESEARCH	$ 0.0	$ 0.0
6.2 EXPLORATORY DEVELOPMENT	0.1	0.1
6.3 ADVANCED DEVELOPMENT	8.5	8.6
6.4 ENGINEERING DEVELOPMENT	28.4	28.5
6.5 MANAGEMENT & SUPPORT	89.2	89.5
6.6 OPERATIONAL SYSTEMS LEVEL	13.3	13.3
TOTAL RDT&E	$139.5	$140.0

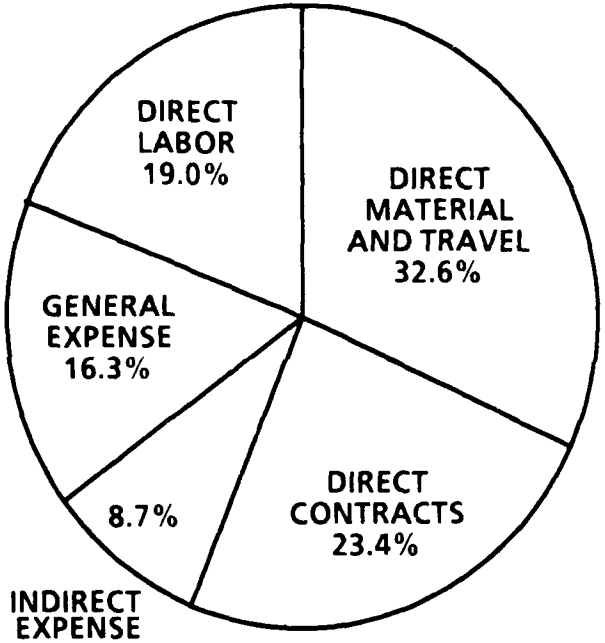
30 SEPTEMBER 1987

NOR

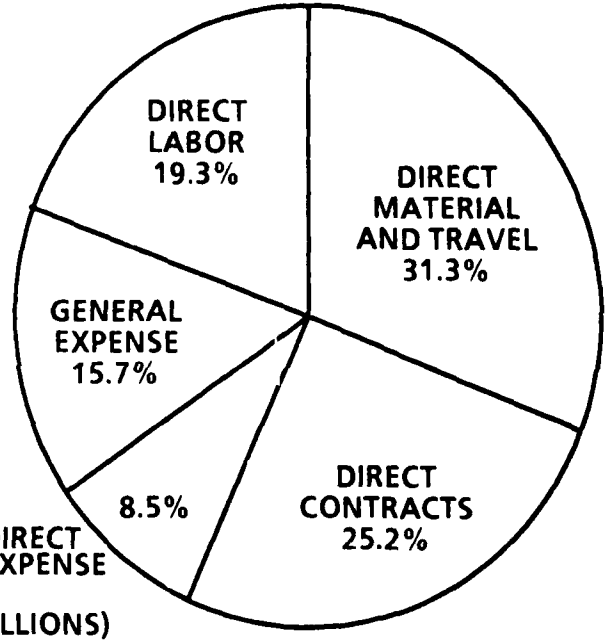
NATC

DISTRIBUTION OF FUNDS

FY88



FY89



($ IN MILLIONS)

	FY88	FY89
DIRECT LABOR	$ 55.2	$ 57.2
DIRECT MATERIAL AND TRAVEL	94.7	92.8
DIRECT CONTRACTS	67.9	74.8
INDIRECT EXPENSE	25.3	25.2
GENERAL EXPENSE	47.3	46.6
TOTAL	$290.4	$296.6

30 SEPTEMBER 1987

NATC

FUNCTIONS

NAVAIRTESTCEN SHALL ESTABLISH IN-HOUSE TEST, EVALUATION, AND ENGINEERING SUPPORT CAPABILITY FOR THE FOLLOWING NAVY AND MARINE CORPS PRODUCTS:

PRODUCT AREA/PRODUCT LINES

PRODUCT AREA	NAVAIRTESTCEN PRODUCT LINE T&E
• ACOUSTICAL SEARCH AND SURVEILLANCE SYSTEMS/EQUIPMENT	• AIRBORNE SYSTEMS • AIRBORNE SONOBUOYS AND SENSORS
• COMBAT SYSTEMS INTEGRATION	• AIRCRAFT • CARRIER SUITABILITY OF AIRCRAFT
• COMMAND AND CONTROL	• AIRBORNE TACTICAL SYSTEMS
• COMMUNICATION SYSTEMS/EQUIPMENT	• AIRBORNE SYSTEMS/EQUIPMENT
• CREW EQUIPMENT AND LIFE SUPPORT	• AIRCREW ENVIRONMENT
• EM/EO/IR SENSORS, RECONNAISSANCE AND SURVEILLANCE SYSTEMS/EQUIPMENT	• AIRBORNE SYSTEMS/EQUIPMENT
• ENVIRONMENTAL	• AIRCRAFT SYSTEMS/ SUBSYSTEMS AND COMPONENTS
• ELECTRONIC WARFARE	• AIRBORNE SYSTEMS

PRODUCT AREA	NAVAIRTESTCEN PRODUCT LINE T&E
• FIRE CONTROL SYSTEMS	• AIRBORNE SYSTEMS
• FREE FALL WEAPONS	• AIRBORNE CARRIAGE/ SEPARATION
• GUNS/AMMUNITION	• AIRBORNE INTEGRATION
• HUMAN PERFORMANCE IN NAVY SYSTEMS	• AIRCREW HUMAN FACTORS
• LAUNCHERS	• AIRBORNE INTEGRATION
• LOGISTICS RDT&E	• AIRCRAFT RELIABILITY/ MAINTAINABILITY/ SERVICEABILITY
• MAJOR RANGE DEVELOP-MENT AND OPERATION	• CHESAPEAKE TEST RANGE
• NAVAL VEHICLES	• AIRCRAFT/AIRCRAFT SUPPORT SYSTEMS
• NAVIGATION	• AIRBORNE SYSTEMS
• OTHER	• AIRCRAFT VULNERABILITY/ COMPATIBILITY • SHIPBOARD CERTIFICATION FOR SPECIFIC AIRCRAFT OPERATIONS
• PERSONNEL EDUCATION AND TRAINING	• OFT, WST, AND RELATED SYSTEMS
• PROPULSION, POWER, AND AUXILIARY MACHINERY SYSTEMS	• AIRBORNE SYSTEMS

30 SEPTEMBER 1987

NATC

NAVAIRTESTCEN MANAGEMENT GOALS

GOAL	OBJECTIVES	GOAL	OBJECTIVES
• SUPPORT NAVY OBJECTIVES RELATIVE TO PERSONNEL RETENTION, SAFETY, EEO, ENERGY CONSUMPTION, AND SECURITY	• IMPROVE CIVILIAN AND MILITARY RETENTION • IMPROVE SAFETY OF ALL PERSONNEL AND PROPERTY • IMPROVE EEO POSTURE OF NAS/NAVAIRTESTCEN • REDUCE ENERGY CONSUMPTION AND EXPAND ALTERNATIVE ENERGY USE • IMPROVE SECURITY AWARENESS	• MATCH FACILITY PLANNING/ CONSTRUCTION TO FUTURE NAVAIRTESTCEN/ TENANT REQUIREMENTS	• DEVELOP LONG-RANGE BASE MASTER PLAN FOR COMPLEX • DEVELOP UTILITIES LONG-RANGE PLAN • DEVELOP SPACE UTILIZATION PLAN • IMPROVE SHORT-RANGE PLANNING PROCEDURES
• PROVIDE EFFECTIVE AND IMAGINATIVE CORPORATE MANAGEMENT TEAM	• DEVELOP AGGRESSIVE MANAGEMENT BY OBJECTIVES AND MERIT PAY SYSTEM PROGRAMS • KEEP CURRENT WITH FLEET REQUIREMENTS AND THE THREAT • SUPPORT AN AGGRESSIVE AVIATION SAFETY PROGRAM AIMED TOWARD MEETING CNO SAFETY GOALS	• INCREASE T&E PRODUCTIVITY AND EFFECTIVENESS	• IMPROVE AIRCRAFT PERSONNEL AND FACILITY UTILIZATION • MATCH ENGINEERING TECHNOLOGY TO NEW FACILITY POTENTIAL • PLAN, SAFELY CONDUCT, AND REPORT PROJECTS ON SCHEDULE, WITHIN BUDGET, WHILE SATISFYING SPONSOR REQUIREMENTS
• DEVELOP WORK FORCE TO MEET REQUIREMENTS	• BALANCE WORK FORCE MIX OF MILITARY, CIVILIAN, AND CONTRACTORS • PROVIDE CAREER DEVELOPMENT PROGRAM FOR CIVILIAN WORK FORCE • DEVELOP RECRUITING/RETENTION PLAN FOR WORK FORCE	• STRENGTHEN THE TECHNOLOGY BASE TO ACCOMMODATE PRESENT/FUTURE WORK LOAD REQUIREMENTS	• ENHANCE TECHNOLOGY GROWTH THROUGH INTERORGANIZATIONAL CONTACT • EXPAND ENGINEERING DEVELOPMENT FUNCTION • IMPROVE PERSONNEL SUPPORT AND DEVELOPMENT

30 SEPTEMBER 1987

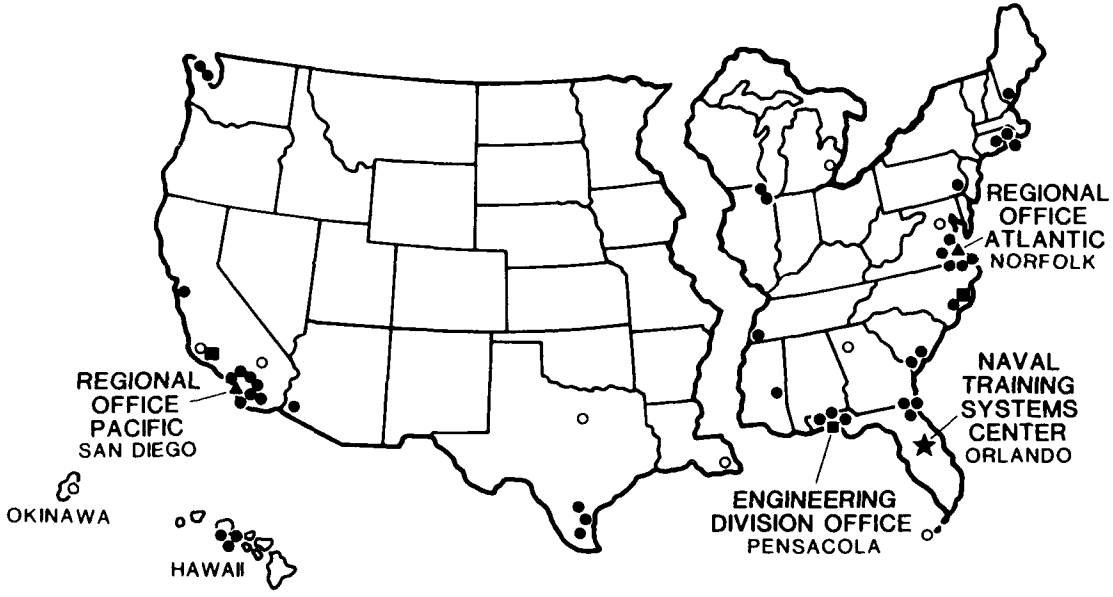
NAVAL TRAINING SYSTEMS CENTER BRIEF

30 SEPTEMBER 1987

NTSC
ORLANDO, FL

NTSC

NAVAL TRAINING SYSTEMS CENTER FIELD OPERATIONS



- ● MAJOR DEVICE LOCATIONS WITH NAVTRASYSCEN IN SERVICE ENGINEERS (ISEs)
- ○ MAJOR DEVICE LOCATIONS WITHOUT ISEs
- ■ MAJOR DEVICE LOCATIONS WITH ISEs AND A NAVTRASYSCEN TRAINER SYSTEMS SUPPORT ACTIVITY (TSSA)

30 SEPTEMBER 1987

NTSC

MISSION

TO BE THE PRINCIPAL NAVY CENTER FOR RDT&E, ACQUISITION AND LOGISTICS SUPPORT OF TRAINING SYSTEMS, TO PROVIDE INTERSERVICE COORDINATION AND TRAINING SYSTEMS SUPPORT FOR THE ARMY AND AIR FORCE, AND TO PERFORM SUCH OTHER FUNCTIONS AND TASKS AS DIRECTED BY HIGHER AUTHORITY.

REF: OPNAVNOTE 5450 OF 6 MAR 86

30 SEPTEMBER 1987

INTRODUCTION

The Naval Training Systems Center (NAVTRASYSCEN) was originally commissioned as the Special Devices Center in 1946, at Port Washington, NY, as an outgrowth of the earlier (1941-46) Special Devices function in the Bureau of Aeronautics. The Center was under the Command of the Office of Naval Research.

In 1950 an agreement signed by the Secretary of the Army and the Secretary of the Navy established the U.S. Army Participation Group at the Center. The Army utilizes technical and administrative services of the Center for research, development and procurement of training equipment. Since 1976 the Army Group has been known as the Project Manager for Training Devices (PM TRADE), reporting to the Army Material Command.

In 1965-66, the Center moved from its overcrowded facilities in New York to its present location as a tenant of the Naval Training Center, Orlando, Florida.

In 1968, command of the Center was shifted from the Chief of Naval Research (CNR) to the Chief of Naval Material (CNM). In 1972 it changed again, to the new Chief of Naval Education and Training (CNET).

The Marine Corps established a presence at the Center through a one-man Liaison Office in 1970. Today one Marine Corps officer is assigned to liaison functions. In addition, seven Marine Corps officers and one enlisted work directly with training system acquisition project teams. The Air Force established a Liaison Office at the NAVTRASYSCEN in 1975 to maintain a close liaison with the Center and PM TRADE. Organization ties are to the Air Force Deputy for Training Systems.

The Center was designated a major shore command in 1979.

In 1983, the Center was again transferred to the CNM, specifically the Director of Navy Laboratories. After disestablishment of the Naval Material Command, the Center transferred to the Naval Air Systems Command, effective 1 October 1985.

The next major move is planned for mid-1988, when the Center will move from its current location to a new three story building at the Central Florida Research Park, about ten miles east of the present location and adjacent to the University of Central Florida.

In FY 1987, the NAVTRASYSCEN has initiated management improvements in several key areas: Acquisition Cost and Leadtime Reform, Obligations, Workload Management, Performance Measurement and Communications. These management initiatives contribute directly to program accomplishments and support NAVTRASYSCEN's role in the Center of Excellence for Training and Simulation.

The Center brings together in one organization the broad mission responsibilities of research, analysis, acquisition, and life cycle support for training systems, primarily but not exclusively those which are simulator-based. Capabilities include:

- Research laboratories for Human Factors, Advanced Simulation Concepts, and Systems and Computer Technology.
- Analyses, studies, tests and evaluations, including identification and documentation of economic and training alternatives, and quality and revalidation assurance inspections of warfare-specific and training systems.
- A matrix-managed development and acquisition capability, including program management, engineering development, logistics planning and unlimited procurement authority, extensively supported by technical input from the research and analysis functions.

INTRODUCTION (Continued)

- A two-tiered life cycle support organization, consisting of (1) Two regional offices (Atlantic and Pacific) that perform a wide variety of modification, in-service engineering and logistics support, functions, largely through a network of In-Service Engineering Offices (ISEOS) and Trainer Systems Support Activities (TSSAS) collocated with major clusters of simulators at training sites, nation-wide and in Hawaii, to provide immediate technical support to user commands; and (2) a consolidated capability in Orlando for major functions which are most efficient to perform centrally.

The Center employs over 1300 civilian employees and has a military allowance of 32 officers and 16 enlisted personnel. New obligation authority for the Center was $813 million in FY 87, and is estimated at over $662 million for FY 88. The Center supports an inventory of over 391 major devices at a total initial investment cost of $1.8 billion.

FACILITIES

ORLANDO

NAVTRASYSCEN headquarters is located currently on the Naval Training Center (NTC), Orlando, FL, (1,095 acres four miles east of the Orlando downtown business district). NAVTRASYSCEN occupies about 208,000 gross square feet in 33 World War II buildings and eight trailers. The US Army Project Manager for Training Devices (PM TRADE), collocated with the NAVTRASYSCEN under a joint service agreement since 1950, occupies approximately 23,000 square feet in five similar buildings.

Additional facilities are at the NAVTRASYSCEN Annex, including the Visual Technology Research Simulator (VTRS) laboratory, and a software support facility. The facilities at the NAVTRASYSCEN Annex were constructed during 1970-1976.

Both properties are covered under a host-tenant agreement with NTC, Orlando. Summary of Orlando assets:

Land Owned/Leased: 0 Acres

Building Space:

Laboratory	49,000 square feet
Administrative	169,000 square feet
Other	35,000 square feet

Construction of NAVTRASYSCEN's new facility began in FY 86 with an anticipated occupancy date of mid-FY 88. The new facilities are located in the Central Florida Research Park adjacent to the University of Central Florida. The new facility will be 281,000 square feet and will replace the buildings at NTC proper, but not the NAVTRASYSCEN annex.

FIELD ORGANIZATION

In addition to Orlando, NAVTRASYSCEN has a widespread technical field network. The two Regional Offices are in Norfolk, Virginia, and San Diego, California. They are tenants of the Naval Station Norfolk, and the Naval Station, San Diego, respectively. Field level engineering and technical support is provided by on-site ISEO and TSSA personnel stationed at 41 fleet and training locations. There are also 3 Quality Assurance and Revalidation Field Offices located in Norfolk, Virginia, Pensacola, Florida, and San Diego, California.

PROGRAM WORK

TECHNOLOGY BASE

The R&D program is balanced between improvements in highly specialized areas of simulation and training technology and providing direct technical support to acquisitions, especially in simulation engineering, instructional delivery methods, training cost control and cost reduction, demonstration of technology effectiveness, proof-of-concept, and reduction of acquisition risk. Extensive use is made of test-beds, such as the Visual Technology Research Simulator (VTRS), the ASW training facility, and the Surface Warfare Advanced Tactics Trainer (SWATT) to integrate and evaluate new training capabilities in a systems context. The Battle Force Research Simulator (BFRS) provides a research facility which simulates a wide range of surface warfare combat operations. Current efforts include:

- Visual and sensor simulation
- Instructor support systems
- Performance enhancement for computer image generation (CIG)
- Simulation fidelity trade-off studies
- Intelligent training systems and gaming technology
- Embedded/onboard training
- ASW Simulation
- Computer architecture for trainers
- CBW defense training
- Portable training aids
- New computer technologies for training systems (e.g., VHSIC, Ada and Artificial Intelligence)

TRAINING ANALYSIS AND EVALUATION

Training analysis and evaluation supports the development, acquisition, management and utilization of training systems through the conduct of front end analyses, special studies and training effectiveness and economic evaluation of training, training systems, training alternatives and supporting systems. The analysis, studies and evaluation functions ensure the use of effective and efficient instructional, simulation and computer technologies in training system design, acquisition and implementation.

Current major efforts include:

- F/A-18 Pilot and Maintenance Training
- Landing Signal Officer Training Program
- AN/SQQ-89 Maintenance and Operator Training
- Landing Craft Air Cushion (LCAC) Trainers
- Marine Corps Tactical Decision Making Training
- SSN-21 Training
- Fire Fighting Training
- Tactical Team Training
- Marine Corps Formal School Training Situation Analysis
- Army Institutional Training
- E6A Total Training Systems
- AN/BQQ Maintenance Part Task Interactive Video Disc Training
- Comprehensive Navy Training Evaluation System
- Pilot Training Risk Assessment
- Mobile Training Facilities for NAVRES

SYSTEMS DEVELOPMENT AND ACQUISITION

Systems acquisition supports primarily Navy Air, Surface and Submarine warfare, Marine Corps, the Army and the Foreign Military Sales Program. Current major programs include:

AIR WARFARE

- Operator trainers for the F-14A/D, E-2C, C-130, P-3C, S-3A/B, A-6 and EA-6B aircraft.
- Operator and maintenance trainers for F/A-18 and AV-8B.
- Contract Flight Crew Training System consisting of two E-6A aircraft and one each operational flight trainer and cockpit procedures trainer.

PROGRAM WORK (Continued)

- Helicopter Operator Trainers for the Army (AH-1, AH-64, UH-60), Marine Corps (CH-46, CH-53, AH-1) Series, Navy (CH-53, SH-2, SH-3 and MH-53) and emerging systems (V-22, F-14D, A6F, P3G).
- TH-57 Jet Ranger Training Helicopter Flight Instrument Trainers and Low Cost Cockpit Procedures Trainers.
- SH-60 Series Sea Hawk Helicopter Operational Flight, Weapons System and Maintenance Trainers.
- T-45 Operational Flight Trainers, Academics and Training Integration Systems.
- TA4J, T-2C, T-34 and T-44 Operator and Familiarization Trainers.

SURFACE WARFARE

- Perry Class Pierside Combat System Team Trainers for team, sub-team and operator training in a multithreat environment.
- Cryptologic Operator/Team Trainer for operator and team training to enable effective detection, identification and tracking of hostile targets.
- Tactical Advanced Combat Direction and Electronic Warfare (TACDEW) Training Facility, team, sub-teams and operator trainers.
- AN/SQQ-89V(1), V(2), V(3) and V(4) Underwater Sensor System operator trainers.
- Surface ASW Team Trainer for ships' sensor operators and decision makers, supporting 15 classes of surface ships.
- Tactical team trainer to provide multiple platform/multithreat procedural, tactical and decision-making training for coordinated exercises.
- Ship propulsion trainers for operation and maintenance of propulsion, auxiliary, electrical and steering systems in the ship engineering spaces.
- Landing Craft, Air Cushion Vehicle Trainers for operating crew members (craftmaster, navigator, engineer and group commander) in craft control and operation.
- Naval Tactical Games (NAVTAG) devices designed to reinforce the tactical skills of the Surface Warfare Officer at the shipboard level.
- Collision Avoidance and Radar Navigation Trainer (CARNS) to exercise shipboard personnel in ship collision avoidance procedures and radar navigation.

SUBMARINE WARFARE

- Submarine combat system team trainers in tactics and operation of fire control systems, sensor systems, periscope systems and weapon systems.
- Submarine Fire Control, Sonar, Electronic Warfare Operator-Trainers. Submarine Pilot and Navigation Trainers for navigation in harbors, rivers and near shorelines.
- Trident Ship Control Trainers in operation and maintenance of diving and steering controls, ballast control and missile launch.
- Submarine Damage Control Trainer to train the man on-the-scene to combat physical damage to the ship and ship's pipelines using on-board damage control equipment.
- Submarine Fire Fighting Trainer to produce controlled Class 'A', 'B' and 'C' training fires to exercise submarine personnel in the extinguishment of a large fire such as a bilge and fast spreading fires such as hull insulation and oil spray.
- Submarine Passive Acoustic Analysis Trainer to provide submarine sonar subjective analysis training to selected submarine personnel.
- Submarine Electronic Warfare Onboard Trainer to provide operator training to electronic support measures (ESM) equipment operators.

LAND WARFARE

- Conduct of Fire Trainers for tank gunnery crews (M1, M2/M3, M60A3)

PROGRAM WORK (Continued)

- Multiple Integrated Laser Engagement System (MILES) which allows casualty assessment of personnel and material via laser simulation of weapons effects for ground forces in combat maneuvers.
- Machine Gun-Automatic Weapons Effects Signature Simulator (MG-AWESS) that simulates weapon sounds and saves money compared to blank ammunition costs.
- Main Tank Gun/Weapon Effects Signature Simulator (MTG/WESS) simulates the main tank gun firing sound.
- Remote Target System (RTS) is a remote target control system to control targets on gunnery ranges.
- Simulated Tank Anti-Armor Gunnery System (STAGS) is used to provide basic and advance gunnery training.
- Wargames to provide tactical decision-making training to Marine Corps leaders.
- Combined Arms Staff Trainers which provide the opportunity for practicing the coordination and employment of supporting arms with troop maneuver and direct fire weapons.
- Precision Gunnery Training System (PGTS) to train Dragon and Tow Gunners.
- Multiple Object Loction System (MOLS) that tracks combat vehicles on gunnery ranges to permit event driven gunnery exercises.
- GUARDFIST 11 — Forward Observer (FO) Trainer to permit sustainment training of reserve components FO's, FDC personnel and gun crews.
- Light Armored Vehicle (LAV -25) turret operations and gunnery trainer for vehicle commander and gunner.
- Tank Gunnery Moving Target System (TWGSS) - For M60A3, M1 and M1A1 Main Battle Tanks. Vehicle appended Simulator for Tactical Engagement Training.
- Tank Gunnery Moving Target System (TWGSS) for M48A5, M60A1 and M60A3 Main Battle Tanks and M2/M3 Bradley Fighting Vehicles. Low Cost, Motion Picture/Laser System; Tank Appended, indoor Training.
- M1 Tank Driver Trainer — Motion Platform, Computer Image Generator, Driver Compartment for M1 Tank.
- M60A3 Tank Driver Trainer — Motion Platform, Terrain Model Board, Driver Compartment for M60A3 Tank.
- Precision Gunnery System (PGS) for M2/M3 Bradley Fighting Vehicle. Vehicle appended simulator for precision tactical engagement training.
- Indoor Simulated Marksmanship Trainer.

MAINTENANCE TRAINERS

- Maintenance training devices for the AN/SQQ-89 ASW system, the M-1 and M-2 tank, the MK 92 fire control system.
- AEGIS Weapon System.
- AV-8B, F/A-18, EA-6B, V-22 aircraft programs.
- "A" School General Trainers.
- Air Traffic Control Trainers.
- Maintenance training devices for the Marine Corps Communication and Electronics, Motor Transport and Engineer Schools.

OTHER

- Environment System trainers for disorientation, damage control and parasail.

SOFTWARE LANGUAGE

The Center is actively involved in developing an in-house capability for implementing the new DOD High Order Language, Ada. This is a cooperative effort with the Army and the Air Force, with the objective of requiring the use of Ada on all appropriate new simulator procurements.

Ada implementation and tailoring or MIL-STD 2164 is also being coordinated with industry through the Tri-service/National Security Industrial Association Computer Working Group.

PROGRAM WORK (Continued)

LIFE CYCLE SUPPORT

NAVTRASYSCEN provides full life cycle support services to the fleet and training activities which are the custodians of the $1.8 billion Cog 2"0" inventory. Services include:

- Provides project engineering expertise, device acquisition services, life cycle technical surveillance/management and contracts for modifications. They work with fleet units and the Regional Offices Activities (TSSA's) to develop engineering concepts, keep hardware and software configuration current and develop Engineering Change Support (ECS) and device Software Life Cycle Management Plans (SLCMP).
- The Software Engineering Facility (SEF) is a centralized computer complex with a Defense Data Network (DDN) interface for incremental tests of training system software during development and acquisition. SEF also supports validation, verification and configuration management of trainer software baselines and Automatic Test Equipment (ATE) systems, common acoustic/oceanographic model technology, and Ada transition management.
- Trainer System Support Activity (TSSA) is an on-site modification support facility for selected programs to keep the trainers current with the weapon system.
- Simulator Operation and Maintenance (SOM) Program provides services to fleet and training commands by planning, budgeting and providing funds for operational phase logistic support for training systems/equipment.
- Inventory Management of Cog 2"0" training equipment inventory from acquisition through disposal.
- Field Engineering provides a wide variety of on-site technical assistance including planning, acquisition, installation, modification, logistic support, COMS assistance and other technical tasks required by fleet and training activities.
- Quality Assurance and Revalidation (QA&R) inspection support is provided to fleet training agents to operate the QA&R program. QA&R provides management and technical personnel in support of the Marine Corps Certification program for aviation training systems.

MAJOR ACCOMPLISHMENTS

VISUAL TECHNOLOGY RESEARCH SIMULATOR (VTRS)
The VTRS is a test-bed for new visual display technology utilizing both CTOL and VTOL simulators. FY 86-87 accomplishments include:

- Pilots performed training trials in the VTOL/SH-60B simulator. This was an in-simulator transfer of training experiment focused on the LAMPS MK III/FFG-7 free deck landing task. Experimental factors included visual field of view, augmented cueing, task chaining and sea state.
- VTRS was funded to assist problems encountered with the USS Midway to define an envelope for allowable carrier motion during aircraft recovery operations. VTRS provided simulation of day and night carrier landings in the CTOL simulator. The simulation provided parametric control of carrier motion representative of the USS Midway problem and effects were evaluated by representatives of NAVSEA and test pilots from NAVAIRTESTCEN.

SIMULATOR SICKNESS
NAVTRASYSCEN was tasked to survey the extent of simulator sickness in selected fixed wing and rotary wing Navy/Marine Corps flight simulators, provide near term fixes for the problem and identify causal/contributory simulator design factors of the problem.

A Navy field manual for simulator sickness has been produced. These guidelines recommend procedures relevant to instructional strategies, scheduling, and operator usage. A test implementation of the field manual at HS-10, NAS North Island determined that the guidelines could reduce the reported incidence of simulator sickness. U.S. Army and Canadian Air Force personnel have requested this field manual.

Data collected in the simulator sickness program have provided several design and specification guidelines for flight simulators which, if implemented, would significantly reduce the incidence of simulator sickness.

Results of research at NAVTRASYSCEN's VTRS facility, field studies, literature reviews, and conferences have produced recommendations for specifications for new simulators for the E-6A and the V-22.

NAVAIRSYSCOM APC-205 requested that a field team be formed which consisted of experts in simulator sickness to evaluate the TH-57C operational flight trainer during the test and acceptance phase of the acquisition process. A simulator sickness and human factors engineering protocol was developed and 16 Navy pilots were provided to act as test subjects. Discrepancy reports were generated from this effort to reduce the severity of the simulator sickness problem. An executive summary was forwarded to NAVAIRSYSCOM APC-205 for review, and recommendations as to whether the simulator visual system should be accepted were made.

CHEMICAL, BIOLOGICAL RADIOLOGICAL DEFENSE WARFARE
NAVTRASYSCEN was tasked by the Fleet Training Group (FTG), Pearl Harbor, via the Commander-in-Chief Pacific Fleet Chemical, Biological and Radiological Defense (CBR-D) Training Working Group, to assess shortfall areas in CBR-D Common Skills training. FTG, Pearl Harbor discovered that personnel arriving for Training Readiness Evaluations (TRE) possessed a very low level of CBR-D Common Skills readiness, resulting in the bulk of TRE time spent getting them up to a minimum level of proficiency. To accomplish this task, NAVTRASYSCEN developed a CBR-D Common Skills Assessment Instrument that has been pre-tested on ships entering TRE at FTG, Pearl Harbor. This procedure assesses 11 Common Skills as identified in the Naval CBR-D Handbook for Training, and allows an assessment of overall CBR-D Common Skills readiness as well as identification of

MAJOR ACCOMPLISHMENTS (Continued)

deficiencies in specific training areas. This instrument is currently in use by FTG, Pearl Harbor, and research is underway to evaluate this procedure on a Navy-wide basis. The results of this pre-test indicated that CBR-D Common skills readiness is below the necessary standards, and shortfalls exist. As a follow-up, NAVTRASYSCEN has produced and delivered draft CBR-D Common Skills training manuals to FTG, Pearl Harbor, for evaluation to address the identified training shortfalls. As a result of participation in an amphibious exercise, KERNEL BLITZ II, several CBR-D related safety issues were identified and reported to NAVSEA. Experimental research has been completed to identify factors that contribute to performance degradation in team tasks. A paper describing this research has been accepted for presentation at the 1987 American Psychological Association annual convention.

SEAWOLF (SSN-21) TRAINERS

Efforts have begun in support of a full range of training devices for the SSN-21. Trainer types include operator, team and maintenance devices for tactical systems, as well as specialized devices such as damage control and firefighter trainers. Efforts involved vary with each trainer, but can include everything from initial POM planning to front-end analysis to procurement support.

AIR WARFARE

Undergraduate Jet Pilot Training — The U.S. Navy T-45 Training System (T-45TS) continues under development with an initial operating capability planned for in September 1990. The T-45TS is a totally integrated system consisting of academics and simulation and flight training, developed to improve Navy Jet Flight Training effectiveness while substantially reducing costs and training time. Major components of the T-45TS are the T-45A Goshawk Aircraft, Device 2F138 Operational Flight Trainer, Device 4E9 Training Integration System and Device 4E10 Academics Subsystem. The T-45TS will also include a contractor logistic support program and a training support center designed to improve availability, reduce operating costs and provide updates and configuration management of the T-45TS.

The following milestones were completed in FY 87:

• Sep 86 - Jun 87	Training Integration System (TIS) Hardware/Software Integration
• Feb 87 - Oct 87	Simulator Hardware/Software Integration
• Feb 87	TIS Critical Design Review
• Jun 87	Academics Preliminary Design Review

Major upcoming activity is the individual, prototype, subsystems to validate design criteria. This will be followed by evaluations (Technical, Operational and System) to ascertain the T-45TS systems capability to train undergraduate jet pilots and meet the overall design goal of reduced operating costs.

V-22 — Now in the middle of a six-year full-scale development program, the V-22 Osprey is an all composite tilt-rotor aircraft that flies like an airplane and hovers like a helicopter. The aircraft will be used by the Navy, Marine Corps, Army and Air Force. The Navy is the executive service for the V-22 full scale development program.

V-22 total training systems are planned for all four services. These training systems are currently programed for delivery to service sites prior to aircraft delivery and acceptance. To support flight training, thirteen Operational Flight Trainers and six Aircraft System Trainers have been identified for procurement beginning in 1991 through the year 1999. Maintenance Training Device Systems are also under development to support the services. Acquisition of these trainers will correspond to the flight trainer delivery schedules.

SUBMARINE COMBAT SYSTEMS

DEVICE 21A3 SCSTT is a combat crew training device which simulates the attack center of SSN Fast Attack Class submarines

MAJOR ACCOMPLISHMENTS (Continued)

using the Combat Control System (CCS) MK1 Fire Control System (FCS). The trainer consists of all the tactical FCS equipments driven by a Simulation/Stimulation (SIM/STIM) AN/UYK-7 computer and an instructor station consisting of five Generalized Operator Consoles (GOC) with CRT's and plasma-controlled keyboards. The instructor displays are driven by a SIM/STIM VAX 11/780 computer and associated peripherals. Two devices are currently in use for training at the NAVSUBSCOL, New London and SUBTRAFAC, San Diego. Seven more units are either under contract or planned for delivery to other submarine training sites through 1990. Each Device 21A43 is integrated with a Device 21B64 BOQ-5 Sonar Trainer and a Device 21B68 Image Generator Based Periscope Trainer to achieve tactical team training.

ASW TRAINING

A contract for seven production units (70 student stations) of a proof-of-concept Passive Acoustic Analysis (PAA) prototype trainer, which was developed in-house by NAVTRASYSCEN under joint OP-01 6.3/OP-29 sponsorship and delivered to SUBTRAFAC, San Diego, was awarded in FY 87. During FY 87, Surface coMmunity ASW personnel became famIliar with the prototype PAA trainer and determined that it was capable of providing excellent, critically needed Advanced and Masters (STG-0417) PAA proficiency training to surface sonar operators. During the Surface Warfare Training Group (SWTG) meeting held during March 1987 at the Fleet ASW Training Center, Pacific, the surface ASW community identified a critical requirement to obtain two units (20 student stations) of the PAA trainer (Device 21H14) as quickly as possible. In response to this pressing need, in May 1987, OP-03 directed NAVSEA (CHENG-L) to acquire two of these units immediately for delivery to FLEASWTRACENLANT/PAC. These units, redesignated Device 14E40 for surface applications, are being procured for delivery in 4th QTR FY-88 and there is a requirement for additional units to be procured at a later date.

Device 14E35/C, AN/SQQ-89 ASW Combat System Acoustic Operator Trainer, simulates the functions of the acoustic sensor systems and mode assessment system which duplicates the functions of the operational systems for the CG-47/DD-963/DD-993/FFG-7/DDG-51 class ships. The first trainer was installed and accepted at FLEASWTRACENPAC in October 1985. Present planning is to procure a total of 4 additional units and is progressing ahead of schedule.

Device 14A12, Surface ASW Team Trainer, will provide ASW team procedural and tactical training and evaluation in a multi-threat environment. The purpose of the trainer is to effectively prepare Naval personnel for combat aboard multi-classes of ships (16 classes). Personnel will be trained for various primary and support missions in surface ASW. The trainer will be comprised of Combat Information Center (CIC), Bridge, Sonar and Own Ship Aircraft mock-ups consisting of programmable general purpose consoles (GPC) allowing flexibility to provide each team member with the capability of exercising essential ASW engagement procedures. The GPC's will be capable of simulating current and emergency operational equipment requisite to ASW team training. The contract for the prototype was awarded in May 1985 with availability for Fleet training scheduled for November 1988. A competition was held for the six follow-on units with a successful contract award in August 1987. The first production unit is scheduled to be available for Fleet training in October 1990.

AN/SPA-25G RADAR EMBEDDED TRAINING

NAVTRASYSCEN is currently involved in a research effort aimed at the development, implementation and evaluation of an embedded training capability in the AN/SPA-25G radar repeater. One of the key components in this project is the development of a software system that will permit the generation of training exercises for the embedded environment. The Scenario Control Software (SCS), the production system for creating training scenarios, has been completed. The SCS allows the creation of

MAJOR ACCOMPLISHMENTS (Continued)

up to 40 movable radar targets, each of which is indexed by parameters associated with radar training. The SCS offers a unique PLAY mode which allows the training scenario developer to review progress on-line and to make modifications efficiently. The anticipated payoff from the overall embedded training program is a self-contained training capacity with the AN/SPA-25G, which will foster a reduction in on-board instructor workload requirements, less reliance on "live" aircraft for training, and more hands-on training per unit time. A significant accomplishment is the procurement and delivery of the target generator to NAVTRASYSCEN. This provides the capability for generating synthetic targets on the SPA-25G.

LOW COST PERSONAL COMPUTER RIFLE MARKSMANSHIP EXPERT SYSTEM

An expert system for rifle marksmanship training has been designed and fabricated at NAVTRASYSCEN. The significant feature of this prototype hardware development is the use of an inexpensive personal computer (PC) in the role of a surrogate instructor to control a training device. This PC-controlled expert system collects real-time shooter information and physiological data and then executes a set of rules that analyzes trainee performance. The rule based expert system controls a video disc which provides appropriate instructional feedback.

The research has demonstrated that an expert system can be performed on a low-cost personal computer. The device is considered to be a solution to the Navy's requirement to provide rifle marksmanship training for large numbers of personnel.

This low-cost, lightweight transportable device has the potential for installation on shore and at sea. It would also benefit the Naval Reserves since no special facilities are required for training.

Strong interest in the device has been evidenced by the Chief of Naval Technical Training for use in recruit training.

AIR TRAFFIC CONTROL TRAINERS

The new generation of ATC training systems will include speech-voice recognition and will be first implemented at NATTC Memphis. Device 15G30, Advanced Shipboard Air Traffic Control Training System (ASATS), and Device 15G31, Shorebased Radar ATC Training System (SATS) will provide introductory training and advanced training for the air controller at the Naval Air Stations. Device 15G32, Tower Operator Training System (TOTS), will provide basic training for the controllers working in the control tower. Device 15G33, Air Traffic Control Proficiency Training System (APTS) will provide remedial training for Air Controllers in the areas of radar and tower control.

Accomplishments during FY 1987 include:

- Award of the Device 15G32 contract.
- Issue of a Request for Proposal to industry for Device 15G33.
- Start installations aboard USS MIDWAY, EISENHOWER, and VINSON.
- Acceptance of device 15G21 aboard USS EISENHOWER.

NAVAL TACTICAL GAME (NAVTAG)

NAVTAG is a microcomputer based wargaming device designed to reinforce tactical skills in surface warfare, anti-submarine warfare and anti-air warfare for the Surface Warfare Officer. R&D efforts were complete in FY 83. One Hundred Twenty-Four (124) systems are in use throughout the Fleet aboard ships, Reserve Training Centers and military schoolhouses. Production of additional systems is underway.

TRIDENT

Since 1973, NAVTRASYSCEN has supported the TRIDENT System Project in training systems at TRITRAFAC Bangor as an overall Training Equipment and Facilities Acquisition Manager (TEFAM). TEFAM responsibilities include facility design and construction coordination for support systems, non-technical collateral equipment management, overall training equipment delivery

MAJOR ACCOMPLISHMENTS (Continued)

scheduling and coordination, site preparation/installation planning and coordination, all training equipment installation, test and acceptance, overall coordination of integrated logistic support outfitting for the training facility, and conduct a Final Acceptance/ Configuration Audit efforts for all training laboratories. At TRITRAFAC, Bangor, the acquisition phase for 55 training laboratories and 500 pieces of tactical and training equipment is underway. Final acceptance and configuration audits for the 48 laboratories installed and in operation at TRITRAFAC, Bangor, were completed by the end of FY 84. NAVTRASYSCEN is tasked to provide life cycle support for TRITRAFAC, Bangor, until 1991.

Current work for TRITRAFAC, Kings Bay, includes the acquisition of training systems for operator and team training in the areas of fire control, sonar, ship control, periscope, electronic warfare, piloting and navigation and maintenance trainers. Trainer advancements and additional capabilities are planned for backfit to TRITRAFAC, Bangor.

MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM (MILES)

Fielding of the Air-to-Ground Engagement System/Air Defense Engagement System (MILES AGES/ADES) continued in 1986. This system allows participation of the COBRA (AH-1), HUGHEY (UH-1), OH-58, CHAPPARELL and VULCAN weapon systems in MILES training exercises.

ON-SITE SOFTWARE SUPPORT

Trainer Systems Support activities (TSSAs) are being planned for the on-site software support and associated trainer configuration management. This work will include maintenance of the data base, configuration control and production of software and hardware modifications for rapid fleet support. To date, TSSAs for the F/A-18 have been established at NAS Lemoore, California, for the AV-8B at MCAS Cherry Point, North Carolina, and for the SH-60B at NAS North Island, California. A TSSA to support the SSQ-89 program has been established at the Fleet ASW Training Center, Pacific, in San Diego, California. Future plans are to establish a total of 18 TSSA's, eleven (11) for Air and seven (7) for Surface trainer system support.

NTSC PERSONNEL

TOTAL ON BOARD	TOTAL MILITARY	TOTAL CIVILIAN	FTP	TPTI	FTP UNGRADED	FTP GRADED
1403	48	1355	1337	18	14	1323

TYPES OF PERSONNEL AUTHORIZED

SCIENTISTS AND ENGINEERS	568
RELATED PROFESSIONAL/TECHNICAL FUNCTIONS	639
CLERICAL	134
SKILLED (WAGE GRADE)	14

AUTHORIZATION	FY 87	FY 88	FY 89
MILITARY	55	48	48
CIVILIAN	1348	1351	1340

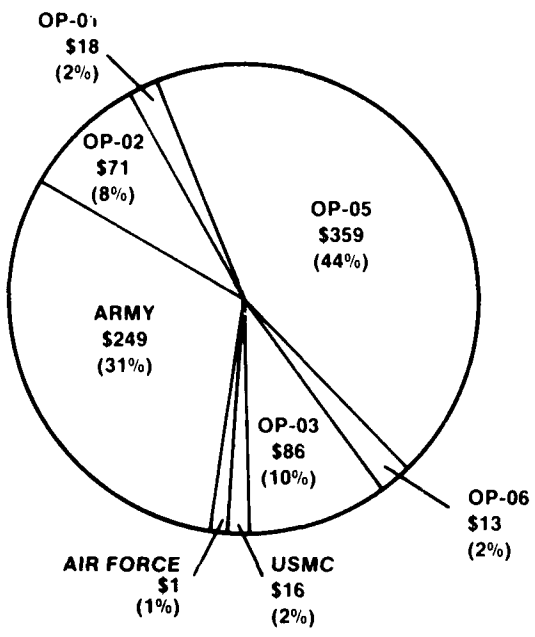
30 SEPTEMBER 1987

NTSC

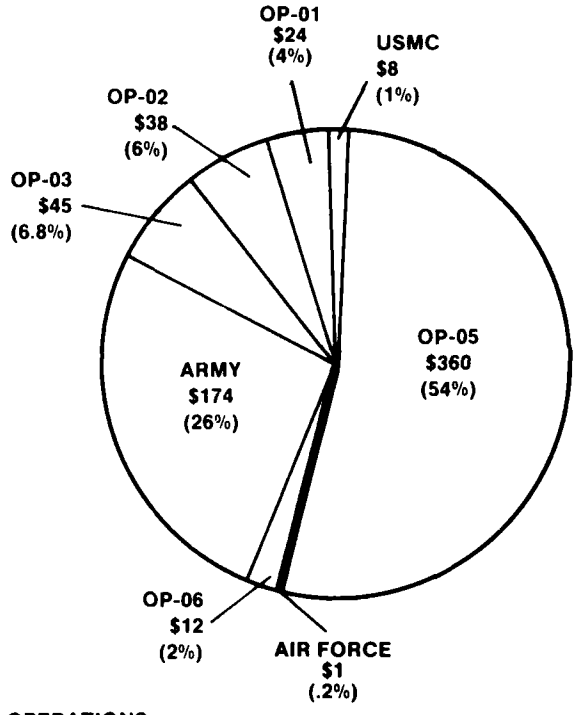
FUNDING BY SPONSOR

NEW OBLIGATION AUTHORITY
($ IN MILLIONS)

FY 1987
ACTUAL $813



FY 1988
$662



DEPUTY CHIEFS OF NAVAL OPERATIONS

OP-01 — Manpower, Personnel & Training
OP-02 — Submarine Warfare
OP-03 — Surface Warfare
OP-05 — Air Warfare
OP-06 — Foreign Military Sales

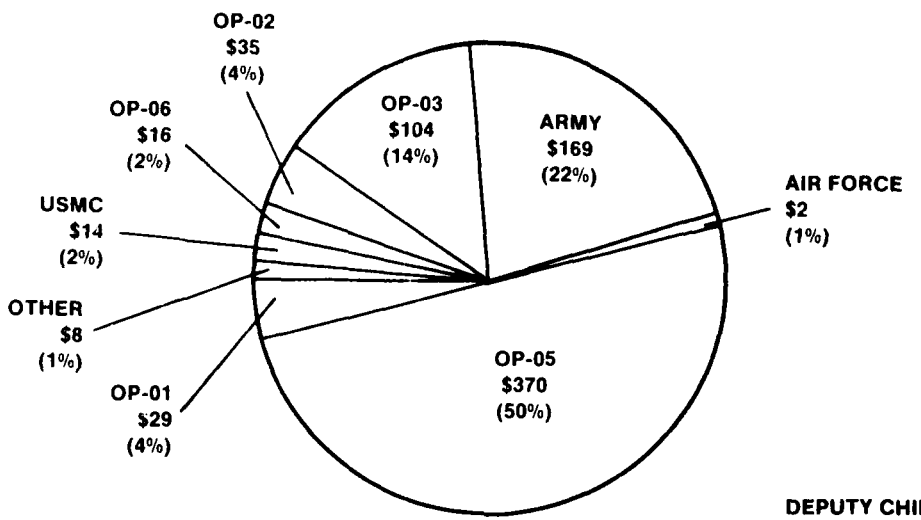
30 SEPTEMBER 1987

NTSC

FUNDING BY SPONSOR

NEW OBLIGATION AUTHORITY
($ IN MILLIONS)

FY 1989
PLANNED $747



DEPUTY CHIEFS OF NAVAL OPERATIONS

OP-01 — Manpower, Personnel & Training
OP-02 — Submarine Warfare
OP-03 — Surface Warfare
OP-05 — Air Warfare
OP-06 — Foreign Military Sales

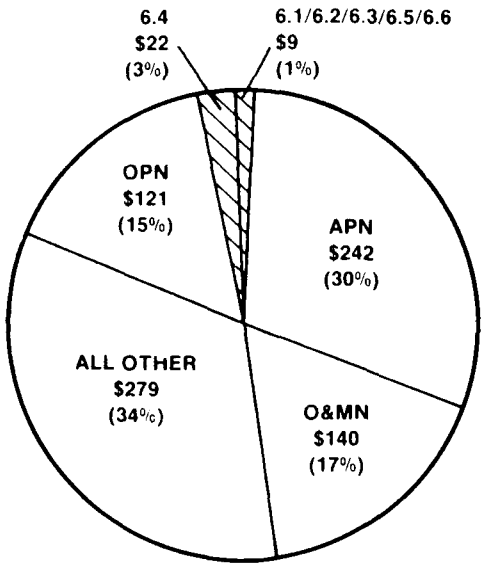
30 SEPTEMBER 1987

NTSC

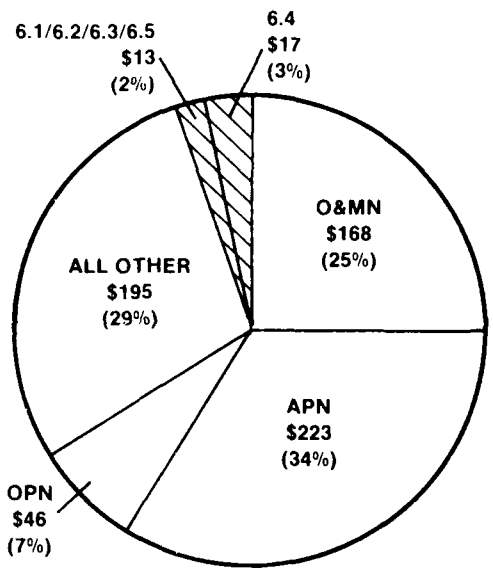
FUNDING BY APPROPRIATION

NEW OBLIGATION AUTHORITY
($ IN MILLIONS)

FY 1987
ACTUAL $813



FY 1988
$662



6.2 — Exploratory Development
6.3a— Advanced Development
6.4 — Engineering Development
O&MN — Operations & Maintenance, Navy
APN — Aircraft Procurement, Navy
OPN — Other Procurement, Navy

RDT&E FUNDS

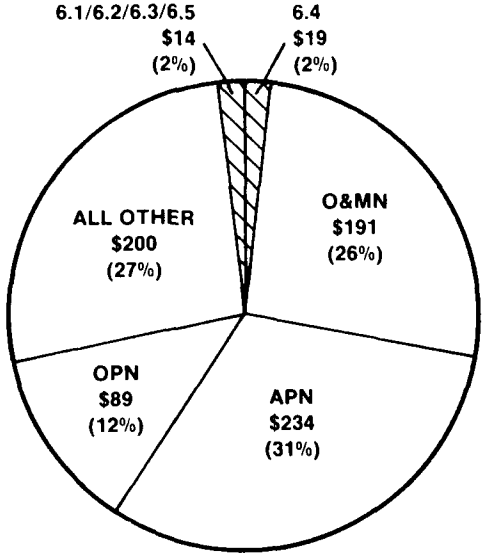
30 SEPTEMBER 1987

NTSC

FUNDING BY APPROPRIATION

NEW OBLIGATION AUTHORITY
($ IN MILLIONS)

FY 1989
PLANNED $747



RDT&E FUNDS

6.2 — Exploratory Development
6.3 — Advanced Development
6.4 — Engineering Development
O&MN — Operations & Maintenance, Navy
APN — Aircraft Procurement, Navy
OPN — Other Procurement, Navy

30 SEPTEMBER 1987

NTSC

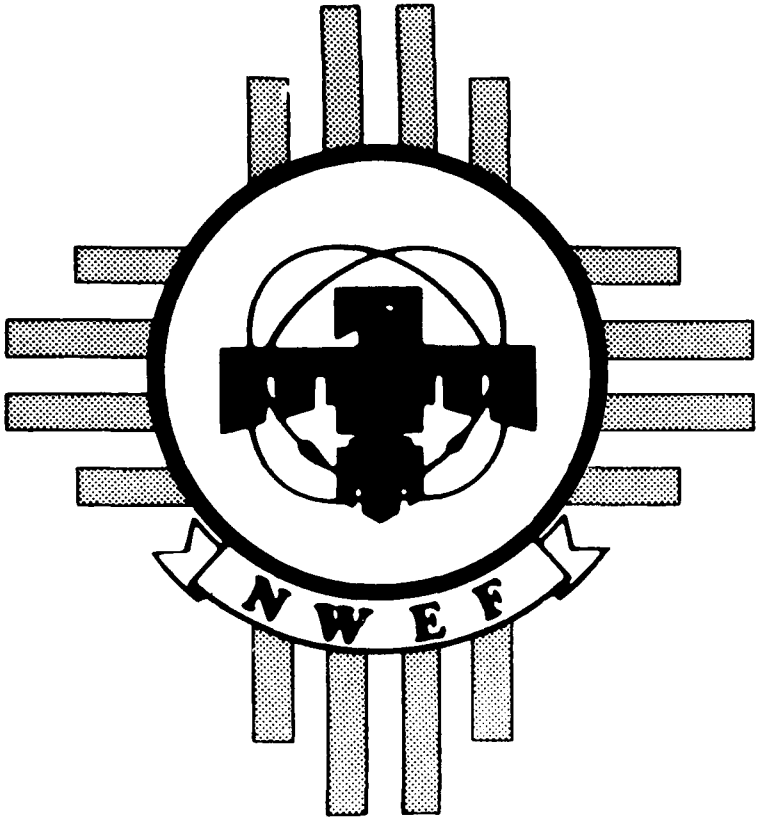
FUNDS BY CATEGORY AND TYPE

NEW OBLIGATION AUTHORITY

($ IN MILLIONS)

CATEGORIES AND TYPE	FY 1987			FY 1988			FY 1989		
	$M ACT.	% OF RDT&E	% OF TOTAL	$M EST.	% OF RDT&E	% OF TOTAL	$M EST.	% OF RDT&E	% OF TOTAL
RDT&E CATEGORY									
6.2 EXPLORATORY DEVELOPMENT	3	10.0	.3	3	10.0	.5	3	9.1	.4
6.3a ADVANCED DEVELOPMENT	5	16.1	.6	7	23.3	1.1	9	27.3	1.2
OTHER RDT&E (6.1/6.5/6.6)	1	3.2	.1	3	10.0	.5	2	6.1	.3
SUBTOTAL	9	29.3	1.0	13	43.3	2.1	14	42.5	1.9
6.4 ENGINEERING DEVELOPMENT	22	70.7	2.7	17	56.7	2.6	19	57.5	2.5
TOTAL RDT&E	31	100.0	3.7	30	100.0	4.7	33	100.0	4.4
OTHER APPROPRIATIONS									
OPERATION & MAINTENANCE, NAVY (O&MN)	140		17.0	168		25.0	191		25.6
AIRCRAFT PROCUREMENT, NAVY (APN)	242		30.0	223		34.0	234		31.3
OTHER PROCUREMENT, NAVY (OPN)	121		15.0	46		7.0	89		11.9
ALL OTHER APPROPRIATIONS	279		34.3	195		29.3	200		26.8
SUBTOTAL	782		96.3	632		95.3	714		95.6
TOTAL	813		100.0	662		100.0	747		100.0

30 SEPTEMBER 1987



NAVAL WEAPONS EVALUATION FACILITY

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

NAVAIR

MISSION

TO PERFORM TESTS, EVALUATIONS, AND PROVIDE TECHNICAL SUPPORT FOR NUCLEAR AND DESIGNATED NON-NUCLEAR WEAPONS AND WEAPON SYSTEMS; MAINTAIN DIRECT LIAISON WITH ALL LEVELS OF COMMAND WITHIN THE NAVY AND OTHER GOVERNMENT AGENCIES WITH RESPECT TO NUCLEAR WEAPON SAFETY; ADVISE AND ASSIST THE CHIEF OF NAVAL OPERATIONS IN PROMOTING AND MONITORING NUCLEAR WEAPON SAFETY AND THE PREVENTION OF NUCLEAR WEAPON ACCIDENTS OR INCIDENTS; PLAN AND CONDUCT NUCLEAR WEAPON SYSTEM SAFETY STUDIES AND REVIEWS; PLAN AND COORDINATE THE NAVY NUCLEAR WEAPONS SAFETY PROGRAM; AND ASSIST IN THE TRIALS OF NAVAL AIRCRAFT AS REQUESTED BY THE BOARD OF INSPECTION AND SURVEY.

OPNAVNOTE 5450
3 SEPT 1968

NAVAIR

INTRODUCTION

The Naval Weapons Evaluation Facility (NWEF) is located in the heart of the nuclear weapons community, at Albuquerque, New Mexico, with the primary purpose to assist in establishing and maintaining a nuclear weapon capability with U.S. Navy combat aircraft, ships, submarines, and Navy/U.S. Marine Corps amphibious forces, and to assure that these nuclear weapon systems can be employed effectively with an adequate degree of nuclear safety. Technical components of the command include:

Air Weapon Systems Department - Conducts airborne test and evaluation projects related to aircraft-delivered nuclear weapons, nuclear training weapons, aircraft weapon delivery systems, control and monitor equipment, aircrew protective equipment, and designated non-nuclear weapons. Provides flight test support to Department of Energy weapon development laboratories. Provides engineering support to the Naval Air Systems Command (NAVAIRSYSCOM) in establishing and maintaining nuclear weapon delivery capability with Navy and Marine Corps combat aircraft from initial procurement throughout the service life of the aircraft. Conducts feasibility studies for new nuclear weapons/weapon systems needed to meet current and future threats. Provides engineering support to NAVAIRSYSCOM through all phases of development, production, and service employment until weapon retirement. Conducts Board of Inspection and Survey (BIS) Trials on nuclear weapon delivery systems of all Navy nuclear-capable combat aircraft. Provides coordination for all safety studies and reviews of Navy aircraft nuclear weapon systems. Provides all technical material required for the studies, and provides study chairperson and technical advisors for the studies.

Nuclear Safety and Weapons Development Department - The Department promotes nuclear weapons safety. Conferences and symposia on nuclear weapons safety are planned and conducted here. Nuclear safety articles are published in the Navy Nuclear Weapons Digest semi-annually. All the Navy nuclear weapon systems safety studies are scheduled here. Nuclear safety secretariat services for the Navy are provided including, filing, analyzing, and reporting accidents, incidents, safety study findings, inspection reports, and unsatisfactory reports. Weapon system electrical, mechanical, and computer software components are analyzed for safety defects. Tests and studies are conducted to determine the nuclear hardness of Navy aircraft. Instructions, manuals, and training aids are prepared to assist operating personnel as they carry out nuclear warfare missions. Environmental data is generated for Stockpile-to-Target documents. Projects are worked to improve the radiation safety of Navy personnel working around stockpiled nuclear weapons. Engineering and management services are provided to lead and support in the development of new nuclear weapons. Computer equipment, software, training, consulting, and security resources are provided for NWEF.

NAVAIR

INTRODUCTION (Cont.)

Surface, Subsurface, and Amphibious Weapon Systems Department - Plans, conducts and reports on safety studies and reviews of nuclear weapon/weapon systems used by Navy surface, subsurface and U.S. Navy/Marine Corps amphibious forces and provides study chairperson and technical advisors. Provides Engineering support to the Fleet on nuclear weapon systems. Provides engineering support to the acquisition managers on new weapon and weapon system development and/or modification. Prepares and continually updates Military Characteristics and Stockpile-to-Target Sequence documents for nuclear warheads and weapons. Conducts feasibility studies to determine need for new nuclear weapons or warheads to counter future threats. Supports the Project Officers Groups (POG) and chairs the POG Safety Working Group. Provides the Design, Review and Acceptance Group (DRAAG) member or technical advisor to Navy, Army and Air Force DRAAGS. Provides Fleet Ballistic Missile (FBM) re-entry body safety engineering support. Provides engineering support to the Tomahawk Cruise Missile Project Office.

Airborne Weapons Publications Department - Develops, verifies, and monitors Nuclear and Conventional Airborne Weapons/Stores handling and loading procedures for use with naval aircraft. Develops, prepares, and maintains all naval aircraft Airborne Weapons/Stores loading documentation including manuals, checklists, and Stores Reliability Cards for both nuclear and conventional airborne weapons. Develops procedures, prepares and maintains Nuclear Cargo loading manuals and checklists for naval logistic aircraft. Develops and maintains the Common Data Package for all Air-to-Air and Air-to-Ground Conventional Weapons/Stores/Fuze Descriptions and aircrew preflight prodedures in addition to a common data package for Nuclear Weapons and associated Bomb Dummy Unit descriptions along with associated delivery, effects, and tactics information, and provides appropriate inputs for all Aircraft Tactical Manuals. Develops procedures, prepares, and issues appropriate manuals and checklists for Conventional Weapons Assembly manual, Weapons Preloading, Weapons Handling and Loading Equipment Configuration, Gun Jam Clearing procedures, Inflight Gun Loading procedures, and other assigned airborne weapons related documentation. Provides technical advisors to Airborne Nuclear Weapons Safety Studies, and provides representation as members on specified panels/teams associated with airborne weapons, naval aircraft, and related documentation. Assists in the preparation and/or provides verification coordination for other assigned weapons related technical manuals. Evaluates fleet problems and makes recommendations concerning airborne weapons loading procedures and publications. Tests and evaluates all airborne nuclear weapons handling and loading equipment with respect to safety and compatability between airborne nuclear weapons and naval aircraft. Provides technical engineering support and recommends design changes to qualify deficient handling/loading equipments.

NAVAIR

INTRODUCTION (Cont.)

HISTORY

The Naval Weapons Evaluation Facility was initially commissioned at Albuquerque, New Mexico in June 1949 as a U.S. Naval Air Detachment, with a mission to provide specified naval aircraft with a nuclear bomb carriage and delivery capability. Subsequently, the Naval Air Detachment was redesignated as the Naval Air Special Weapons Facility (NASWF). During this period the Chief of Naval Operations requested the Bureau of Ordnance to establish an acceptance program for nuclear weapons and associated materials, its purpose to evaluate weapons systems as to reliability, operability. safety, and suitability. The project was assigned to the Naval Ordnance Test Station, China Lake. A second group was established at Albuquerque when China Lake set up a branch of civilian engineers for weapon acceptance and vulnerability.

In 1958, The China Lake branch was redesignated by the Bureau of Ordnance as the Naval Nuclear Ordnance Evaluation Unit (NNOEU), and placed under command of the Commanding Officer of the Naval Air Special Weapons Facility under a "two-hat" arrangement.

The Naval Air Special Weapons Facility and the Naval Nuclear Ordnance Evaluation Unit were combined in March 1961 into the Naval Weapons Evaluation Facility (NWEF), under management control of the Bureau of Naval Weapons. In September 1968, the facility was officially placed under management control of the Naval Air Systems Command where it remains today.

For almost thirty years, from September 1949, the facility was under the area command of Eighth Naval District. However, on 1 July 1979 NWEF was transferrd to the area command of the Eleventh Naval District, San Diego, and on 1 October 1980, was transferred to Commander, Naval Base (COMNAVBASE), San Diego, Calif., on disestablishment of the Naval Districts.

OPNAVNOTE 5400 of 25 NOV 1981, further transferred NWEF to the area control of the Chief of Naval Air Training, Corpus Christi, TX.

NAVAIR

FACILITIES

The Naval Weapons Evaluation Facility is located as a tennant activity on Kirtland Air Force Base, Albuquerque, New Mexico. Acreage, building usage, and capital investment are as follows:

Land: Seven acres Government-owned
Buildings:
RDT&E/lab space: 2,000 sq ft
Administrative: 53,592 sq ft
Other (hanger): 94,926 sq ft

Acquisition Cost:
Real Property: $9,600,000
Equipment: $998,000

Although not Navy-owned, some of the facilities used by, and available to NWEF and other Navy users are listed below.

RANGES

The U.S. Army White Sands Missile Range. White Sands Missile Range, a national range, offers major RDT&E facilities to all the military services and NASA. Facilities are available not only to U.S. Government Agencies, but also to qualified civilian and foreign users. Programs involving surface-to-air and surface-to-surface missiles and rockets as well as airborne weapons systems are supported in such varied test as system accuracy and reliability, guidance system evaluation, warhead compatibility, quality assurance, field service firings, etc. Support is also provided for such diverse projects as research vehicles of various types, balloons, target missiles and rockets, object and bomb drop test, target drones, and orbital vehicles. The main range comprises an area of 40 x 100 mi., with a 40 x 40 mi. range extension available. The range is equipped with cinetheodolite and telescope optical systems, electronic sky screen equipment, doppler velocity and position system, solid angle measuring equipment, instrumentation radar and miss-distance radar, closed circuit television, telemetry systems, and real-time date analysis capabilities. A laser tracking system is being developed.

The Department of Energy Tonopah Test Range. The Tonopah Test Range is operated by Sandia Laboratories for the Department of Energy (DOE/MA). It came into limited use in 1957 after similar facilities at Salton Sea Test Base and Yucca Flat Test Base, on the Nevada Test Site, became inadequate. Tonopah Test Range was originally designed and equipped to gather raw data on aircraft-delivered inert test vehicles coming under DOE cognizance. Over the years the facilities and capabilities at Tonopah have been expanded to accommodate a wide variety of tests related to the DOE weapons development programs. When not required for DOE tests, Tonopah Range is available on a reimbursable basis to other government agencies or

contractors. In this role, the range provides regular support for the Air Force, Army, and Navy operational and test groups, and for some defense contractors. The variety of tests scheduled at Tonopah requires complete and versatile instrumentation. As requirements change, equipment is updated and modified to meet new operational conditions. Range operating hours are flexible and are dependent on types of scheduled tests and the hours of daylight. The primary date gathering system consists of eight Contraves cinetheodolite stations.

COMPUTER FACILITIES

NWEF Computer Facilities. The Naval Weapons Evaluation Facility has 2 Perkin Elmer 3210 minicomputers and 65 microcomputers on site. In FY 88, 20 additional microcomputers will be purchased. NWEF has arrangements with the Air Force Weapons Laboratory to use their Cyber 176, VAX and CRAY computers, with the Defense Nuclear Agency to use their Cyber 176 computer and with the Los Alamos National Laboratory to use their CRAY computers. NWEF is currently on line with the CURTS/AWCAP system at Point Mugu, and with the DDN through the Air Force Weapons Laboratory.

NUCLEAR EFFECTS TEST FACILITIES

The U.S. Army Linear Electron Accelerator (Gamma LINAC). The Gamma LINAC, operated by the Nuclear Effects Branch, White Sands Missile Range, is available for test of transient radiation effects on electronics (TREE) for electronic systems, subsystems, or components.

Air Force Weapons Laboratory Pulse Calibration and Simulation (ALECS) Facility. The ALECS facility tests components and/or systems for high-altitude EMP vulnerability and develops and evaluates protective techniques through simulation. It is a vertically polarized plate simulator and was the forerunner of the ARES facility. Ancillary equipment includes the RF shielding instrumentation room and in various systems and devices.

The Defense Nuclear Agency Advanced Research Electromagnetic Simlator (ARES). This facility was developed and designed by the Defense Nuclear Agency with technical support from the Air Force Weapons Laboratory. The facility is intended to provide a threat-level electromagnetic test environment to make possible experiments that will

provide realistic data to support analysis and evaluation; of the EMP vulnerability and survivability of complete missile systems at higher altitudes. The simulator is composed of three major components: (1) the transmission line, (2) the high-voltage pulser, and (3) the terminator. Ancillary equipment includes the RF-shielded instrumentation room and the various EMP sensors, probes, telemetry systems, and data recording devices.

The Air Force Weapons Laboratory Vertically Polarized Dipole (VPD) Facility. The vertically polarized dipole antenna is designed as a resistively loaded inverted cone with its axis normal to a conducting ground plane and excited by a pulse generator. The VPD facility essentially is a low-level research tool rather than an instrument for high-confidence EMP environment due to the electromagnetic field interaction between the ground and the aircraft. The name Vertically Polarized Dipole is derived from the fact that the electric field radiated by the antenna is vertically polarized. The VPD facility with its low-level, vertically polarized, omnidirectional, electromagnetic pulse, (EMP) simulator is used for determining EMP effects on aircraft systems.

The Air Force Weapons Laboratory TRESTLE Facility. This facility consists of a simulator for generating a horizontally; polarized electric field and a vertically polarized electric field and a vertically polarized magnetic field and will accomodate aircraft up to the size of a BOEING 747. The pulse generator consists of small pulse units, utilizing four MARX generators. It can deliver a threat-level pulse which can easily be related to the criterion pulse; it removes the aircraft from the surface of the earth; and it couples in the important horizontal components of the pulse.

NAVAIR

PROGRAM WORK

NWEF

Program effort is directed primarily toward establishing and maintaining a safe and effective nuclear weapon capability for U.S. Navy and Marine aircraft, ships, submarines, and Navy/Marine amphibious forces; and to assist NAVAIRSYSCOM and other Navy facilities in flight test of designated non-nuclear stores. Major areas of effect include:

Nuclear Weapon System Safety

Nuclear Safety Analysis

Assistance to President, Board of Inspection and Survey

Air-Launched Nuclear Weapon Systems

Ship-Launched Nuclear Weapon Systems

Submarine-Launched Nuclear Weapon Systems

Amphibious Forces Nuclear Weapons

Logistic Transport of Nuclear Weapons

Nuclear Warheads/Weapons

Nuclear Weapon Training Shapes

Nuclear Weapon Effects

Nuclear Survivability

Generally, these programs fall into two broad categories: (1) systems programs and (2) technology programs. Representative systems programs include:

U.S. Navy Attack Aircraft/Tactical Nuclear Weapon Systems

U.S. Navy ASW Aircraft/Nuclear Depth Bomb Systems

Non - US NATO Aircraft Program of Cooperation

Weapon Loading Manuals, Checklists/All U.S. Navy Aircraft

Surface Ships/Anti-Air, Anti-Ship, Anti-Submarine Nuclear Weapon Systems

Submarine/Fleet Ballistic Missile and Nuclear Anti-Submarine Weapons Systems

Amphibious Forces/Nuclear Artillery Shells and Demolition Munitions

30 SEPTEMBER 1987

NAVAIR

PROGRAM WORK (Cont.)

NWEF

Representative technology programs include:

Cruise Missile Development and Applications

Nuclear Warhead Weapon Development

Nuclear Safety Programs

Nuclear Effects Studies

Nuclear Survivability Applications

Software Analysis Standards and Criteria

Emergency Denial Methods

NAVAIR

ACCOMPLISHMENTS FY 87

- COMPLETED OPERATIONAL SAFETY REVIEWS ON THE A-6E AIRCRAFT, THE A-7B/E AIRCRAFT, THE NP-3C AIRCRAFT, AND THE ATLANTIC AIRCRAFT.
- COMPLETED SAFETY EVALUATIONS ON THE LINEAR ELECTO-MAGNETIC ACTUATOR (LEMA) FOR THE BRU-14 BOMB RACK, AND ON MAINTENANCE RADIATION SHIELDS FOR USE WITH THE B57 NUCLEAR BOMB.
- COMPLETED AMAC SYSTEM RECERTIFICATION TESTS OF A-4M AND A-6E AIRCRAFT.
- COMPLETED SOFTWARE EVALUATIONS TO ESTABLISH DELIVERY CAPABILITIES FOR P-3C AND A-6E AIRCRAFT NUCLEAR WEAPONS DELIVERY SYSTEMS.
- COMPLETED WET I TEST SERIES TO EVALUATE SEALANCE WATER ENTER CHARACTERISTICS.
- COMPLETED BDU TESTS TO EVALUATE IMPROVED BALLISTICS AND CHANGES IN BDU FUNCTIONAL CIRCUITRY.
- CONDUCTED ANALYSES TO EVALUATE ACCEPTABILITY OF HARDWARE CHANGES AND ECP'S PROPOSED FOR SH-3, P-3, AND A-6 AIRCRAFT.
- PARTICIPATED IN AIRCRAFT AND NUCLEAR WEAPON SYSTEM DESIGN, DEVELOPMENT, AND COORDINATION MEETINGS INCLUDING THE B61 POG, AND AMAC POG, AND SYSTEM I AMAC TEST PHILOSOPHY SUBGROUP, A-6E SWIP PLANNING MEETINGS, A-6F NITEWOG, AND THE F/A-18 POG.

30 SEPTEMBER 1987

NAVAIR

MAJOR ACCOMPLISHMENTS

NWEF

THE ACCOMPLISHMENTS LISTED BELOW ARE GENERIC IN NATURE DUE TO THE SENSITIVITY AND TECHNICAL NATURE OF THE PROGRAMS CONDUCTED AT NWEF.

NUCLEAR SAFETY PROGRAM

COMPLETED 11 NUCLEAR WEAPON SYSTEMS SAFETY SUTDIES. MAINTAINED THE NUCLEAR SAFETY CERTIFICATION OF OVER 80 WEAPON/PLATFORM COMBINATIONS.

TEST AND EVALUATION

DURING FY 1987, FLIGHT TEST PROGRAMS WERE CONDUCTED TO EVALUATE FINAL A-4M ARBS SOFTWARE MODIFICATIONS, P-3C ECP-975, AND A-6E E240 DELIVERY SOFTWARE. NWEF ALSO PROVIDED FLIGHT SUPPORT TO SNLA IN DEVELOPMENT OF ND/SB PARACHUTES AND FEASIBILITY STUDIES OF AN EARTH PENETRATOR. NWEF PARTICIPATED IN EVALUATION OF NEW—DESIGN FLOATATUIB GEAR DYRUBG CONREP AT SEA, AND ALSO IN EVALUATION OF TRUCKS FOR C-9 LOADING EVOLUTIONS. NWEF INITUATED ACTION TO PROCURE AN AMAC SYSTEM SURVELIENCE TEST SET TO ENSURE CONTINUED NAVY AIRCRAFT COMPLIANCE WITH AMAC SPECIFICATION REQUIREMENTS.

30 SEPTEMBER 1987

NAVAIR

MAJOR ACCOMPLISHMENTS (CONT'D)

NWEF

WEAPONS DEVELOPMENT

CONTINUED PARTICIPATION IN ALL ASPECTS OF THE DEVELOPMENT OF A NEW FAMILY OF NAVY ANTISUBMARINE TACTICAL NUCLEAR WEAPONS. CONTINUED PARTICIPATION IN THE ONGOING DEVELOPMENT OF THE NEW WARHEAD FOR THE TRIDENT II WEAPON SYSTEM.

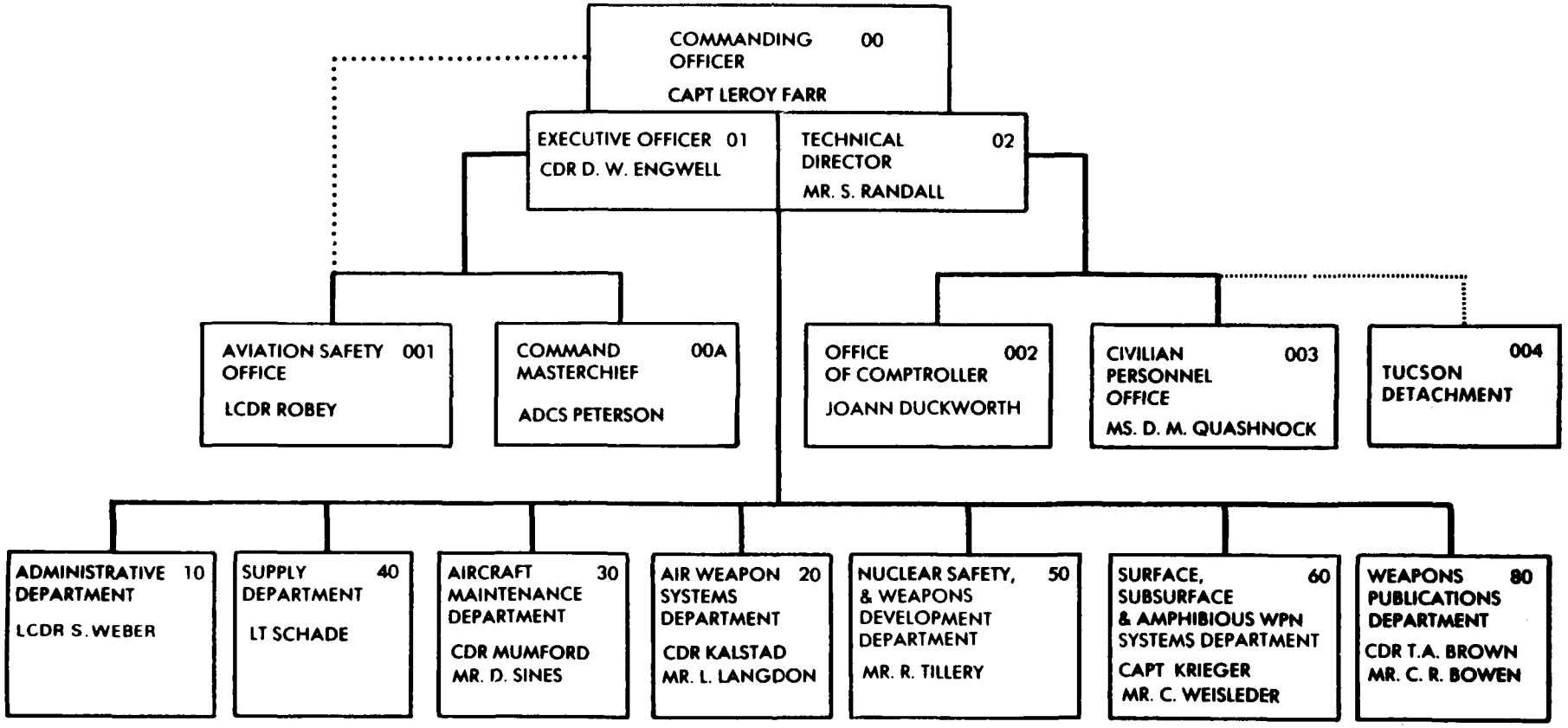
DURING FY 1987, NWEF PROVIDED FLIGHT TEST SUPPORT TO NUSC/SNLA FOR SEALANCE WATER ENTRY STUDIES, AND CONTINUED TO PLAN FOR ND/SB GROUND AND FLIGHT TESTS WHICH WILL COMMENCE UPON PHASE III STARTUP

WEAPONS PUBLICATIONS

CONTINUED AS COGNIZANT FIELD ACTIVITY (CFA) FOR ALL NAVAIR WEAPONS/ STORES LOADING PUBLICATIONS, WHICH INCLUDES 45 DIFFERENT TYPE AIRCRAFT, 5 PRELOADED PUBLICATIONS AND 6 AERIAL TARGET PUBLICATIONS FOR A TOTAL OF 981 PUBLICATIONS, THIS YEAR 7 MANUALS WERE REVISED, 4 OF WHICH INVOLVED INCORPORATION OF SUBSTANTIAL CHANGES. OVER 279 REVISIONS/CHANGES TO LOADING CHECKLISTS AND SRC'S WERE PROCESSED. PRODUCED AND UPDATED WEAPONS AND FUZE DESCRIPTIONS AND CHARACTERISTICS AND PREFLIGHT CHECKS FOR 19 TACTICAL MANUALS. A NUCLEAR CHECKLIST CONFERENCE WAS HELD TO SOLICIT INPUT FROM FLEET USERS. THIS CONFERENCE RESULTED IN MUCH NEEDED CHANGES TO NUCLEAR LOADING PUBLICATIONS MAKING THEM USER FRIENDLY.

NAVAIR

NAVAL WEAPONS EVALUATION FACILITY



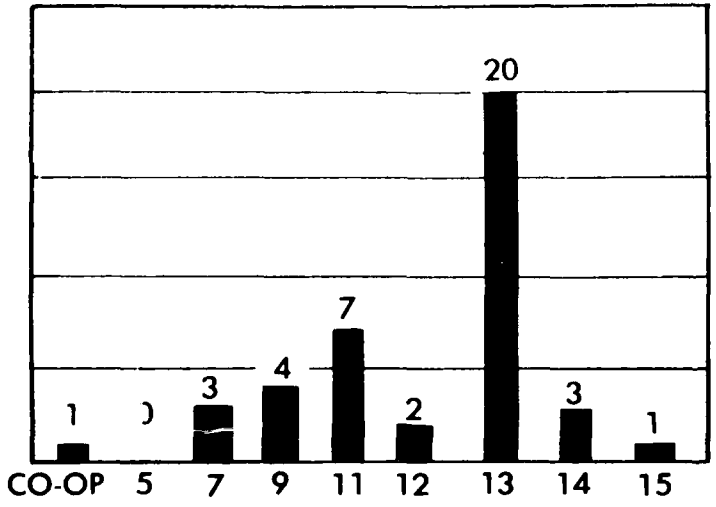
* CIVILIAN PERSONNEL OFFICE IS PMTC RESPONSIBILITY.

30 SEPTEMBER 1987

NWEF PERSONNEL

AUTHORIZED	MILITARY	**CIVILIAN	GS	FWS
	135	132	117	9

**FULL TIME PERMANENT



SCIENTISTS AND ENGINEERS BY GRADE

ON BOARD

SCIENTISTS AND ENGINEERS	40
ADMINISTRATIVE	25
TECHNICAL	16
OTHERS	36
UNGRADED	9
	126
GENERAL ENGINEERS	21
ELECTRONICS ENGINEERS	14
NUCLEAR ENGINEERS	2
AERONAUTICAL ENGINEERS	1
COMPUTER SCIENTISTS	1
MATHEMATICIAN	1
	40

CIVILIAN

ON BOARD: 126
COMMITMENTS: 1
RECRUITMENTS: 7

MILITARY

ON BOARD: 21 OFFICERS*
103 ENLISTED*

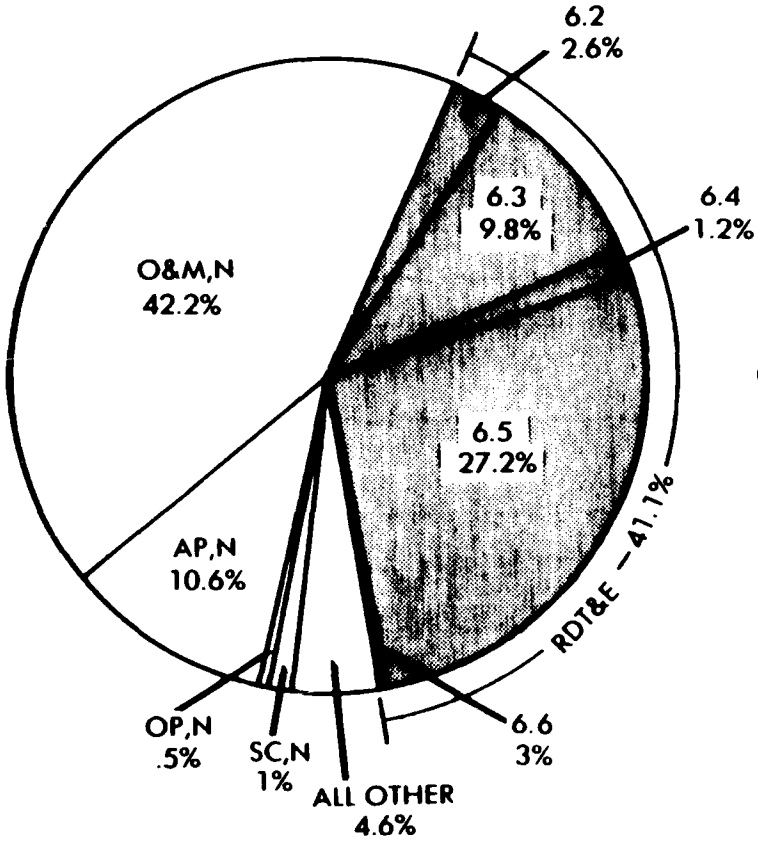
30 SEPTEMBER 1987

*INCLUDES FIVE USMC LIAISON ALLOWANCE (1 OFFICER, 4 ENLISTED)

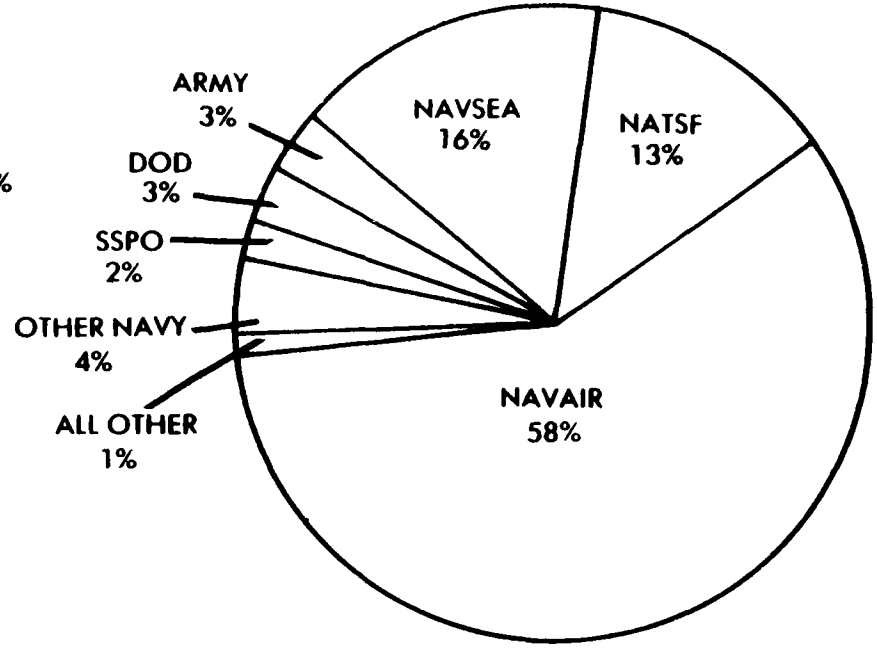
SOURCE OF FUNDS
FY 1987
ACTUAL

NAVAIR

FUNDING BY APPROPRIATION



FUNDING BY SPONSOR

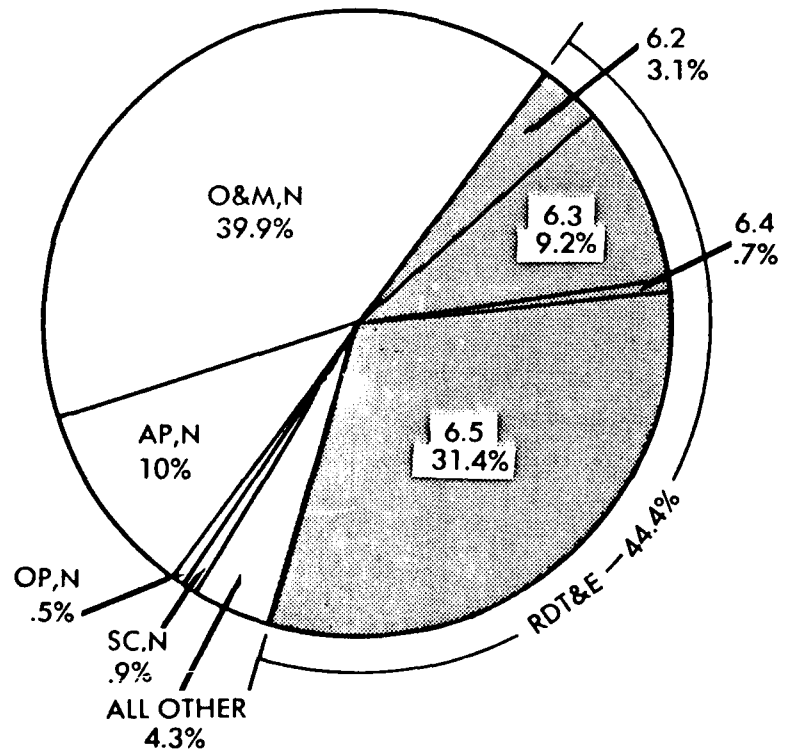


30 SEPTEMBER 1987

NAVAIR

SOURCE OF FUNDS
FY 1988
ESTIMATED

FUNDING BY APPROPRIATION



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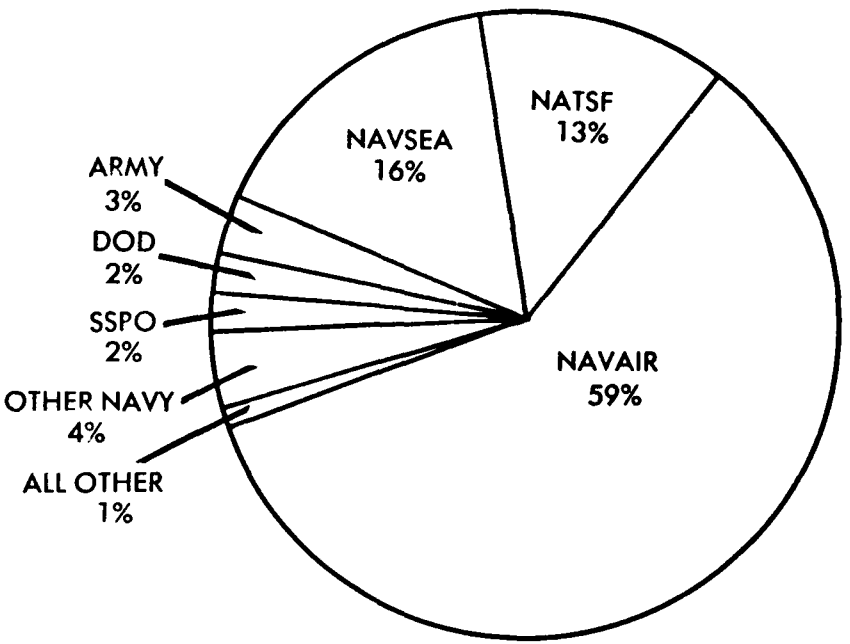
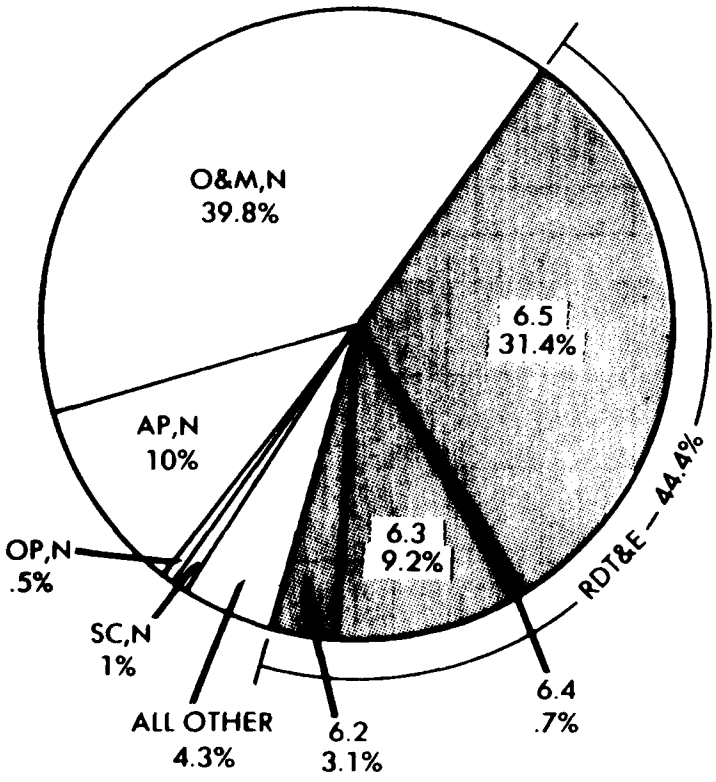


30 SEPTEMBER 1987

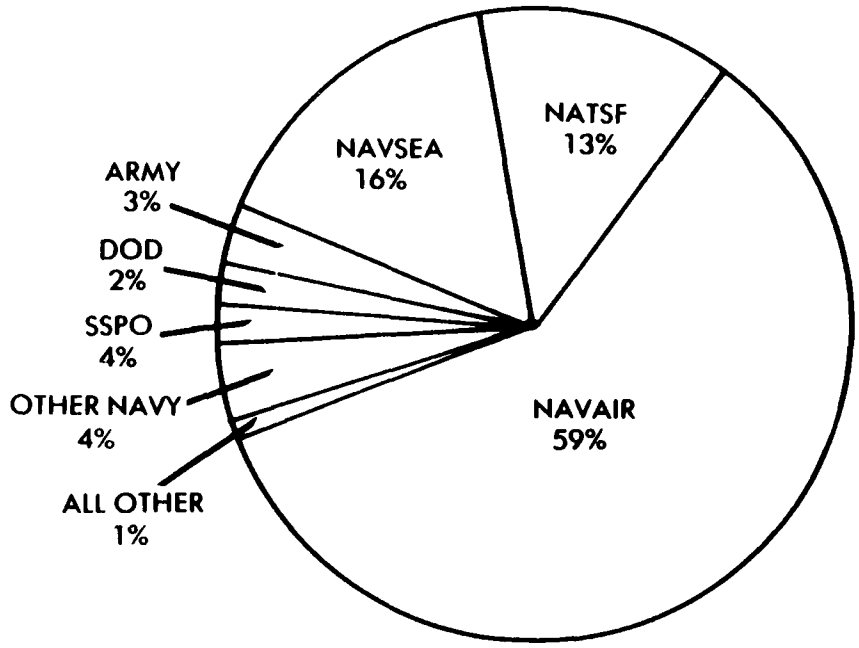
NAVAIR

SOURCE OF FUNDS
FY 1989
ESTIMATED

FUNDING BY APPROPRIATION



FUNDING BY SPONSOR



30 SEPTEMBER 1987

NAVAIR

FUNDS BY CATEGORY AND TYPE

CATEGORIES & TYPE	ACTUAL FY 1987 $K ACT	% OF RDT&E	% OF TOTAL	ESTIMATE FY 1988 $K EST	% OF RDT&E	% OF TOTAL	ESTIMATE FY 1989 $K EST	% OF RDT&E	% OF TOTAL
RDT&E,N (CATEGORY)									
6.1 RESEARCH									
6.2 EXPLORATORY DEVELOPMENT									
6.3A ADVANCED TECHNOLOGY DEVELOPMENT									
SUB TOTAL									
6.3B ADVANCED DEVELOPMENT	884	23.7	9.8	9.11	20.7	9.2	938	20.7	9.2
6.4 ENGINEERING DEVELOPMENT	66	1.9	.7	68	1.6	.7	70	1.6	.7
6.5 MANAGEMENT AND SUPPORT	2,461	66.2	27.2	3,096	70.7	31.4	3,189	70.7	31.4
6.6 OPERATIONAL SYSTEMS DEVELOPMENT	7	.2	.1	0	0	0	0	0	0
RDT&E,N SUB TOTAL	3,418	92	37.8	4,075	93	41.3	4,197	93	41.3
OTHER RDT&E	298	8	3.3	307	7	3.1	316	7	3.1
TOTAL RDT&E	3,716	100	41.1	4,382	100	44.4	4,513	100	44.4
OTHER APPROPRIATION									
(O&M,N) OPERATION & MAINTENANCE, NAVY	3,816	0	42.2	3,930	0	39.9	4,048	0	39.8
(AP,N) AIRCRAFT PROCUREMENT, NAVY	957	0	10.6	986	0	10	1,016	0	10
(OP,N) OTHER PROCUREMENT, NAVY	44	0	.5	45	0	.5	46	0	.5
(WPN) WEAPONS PROCUREMENT, NAVY	0	0	0	0	0	0	0	0	0
(SC,N) SHIPBUILDING & CONVERSION, NAVY	87	0	1	90	0	.9	93	0	1
OTHER	415	0	4.6	4 27	0	4.3	440	0	4.3
APPROPRIATION SUB TOTAL	5,319	0	58.9	5,478	0	55.6	5,646	0	55.6
TOTALS	9,035		100	9,860		100	10,159		100

30 SEPT 1987

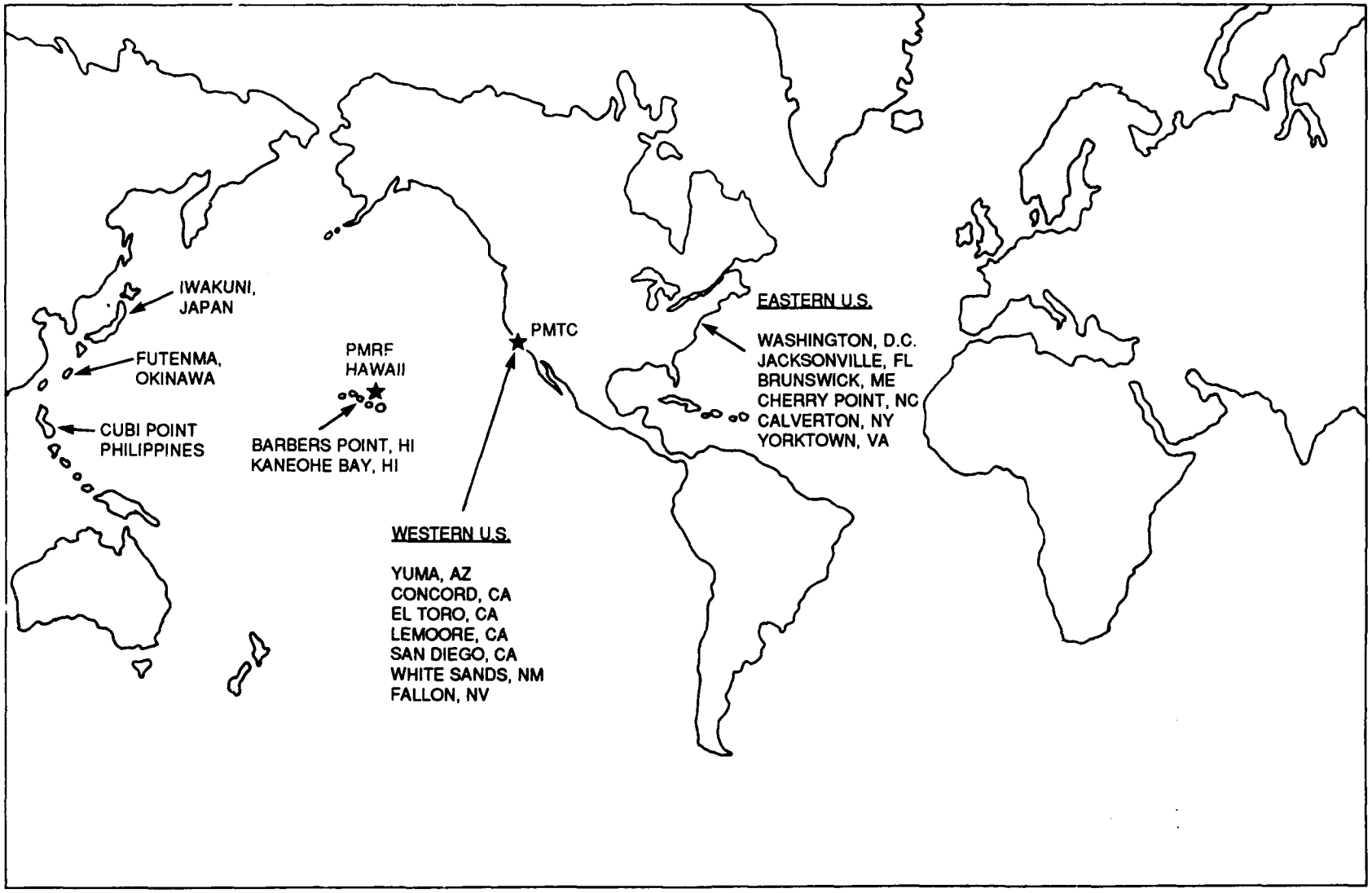
PACIFIC MISSILE TEST CENTER

POINT MUGU, CALIFORNIA

BRIEF

30 SEPTEMBER 1987

PMTC & DETACHMENTS



30 SEPTEMBER 1987

PMTC

MISSION

TO PERFORM DEVELOPMENT TEST AND EVALUATION, DEVELOPMENT SUPPORT, PRODUCTION SUPPORT, FOLLOW-ON ENGINEERING, LOGISTICS AND TRAINING SUPPORT FOR NAVAL WEAPONS SYSTEMS, ELECTRONIC WARFARE SYSTEMS, TARGET SYSTEMS, AND RELATED SUPPORT EQUIPMENT DEVICES; PROVIDE MAJOR RANGE, TECHNICAL AND BASE SUPPORT FOR FLEET USERS AND OTHER DEPARTMENT OF DEFENSE AND GOVERNMENT AGENCIES.

30 SEPTEMBER 1987

INTRODUCTION

The Pacific Missile Test Center (PMTC) continues to be the Navy's primary test and evaluation facility for air-launched weapons and airborne Electronic Warfare (EW) systems. As an adjunct to NAVAIR weapon system support, PMTC has evolved facilities and talent in tactical software and has been designated as a Software Support Activity (SSA) for many of the Navy technical systems.

An increasing amount of test and evaluation is now being conducted more economically by non-destructive simulation. In specially equipped laboratories a multitude of conditions can be simulated. The data thus gathered, together with flight data, form the basis for detailed weapon system evaluation. In the area of electronic warfare, laboratories simulate many of the electronic countermeasures and counter-countermeasures that weapon systems will confront.

To support both range operations and laboratory tests, PMTC utilizes a new modern computer center which can provide both real-time data processing and post operational data reduction.

To accommodate long-range weapons and multi-participant exercises, PMTC has developed the Extended Area Test System (EATS), which extends instrumentation 250 nautical miles seaward. The system uses ground stations and specially equipped aircraft to monitor, control, and communicate with participants. Also, PMTC supports the Mobile Sea Range, which allows the Fleet to conduct realistic training exercises and collect data while afloat practically anywhere in the world.

For operations which must be conducted simultaneously on the sea, in the air, and under the water, PMTC has a subordinate command, the Pacific Missile Range Facility (PMRF) on the Hawaiian Island of Kauai. PMRF combines surface instrumentation and other range facilities with two underwater ranges, one a 50-square-mile range and the other covering an 880-square-mile area. The smaller range is ideal for programs requiring extreme accuracy, while the large range permits tactical weapons to be tested or free-play Fleet exercises to be conducted.

Another subordinate command, the Naval Air Station provides base support to PMTC, to a wide variety of tenants, and to other Federal organizations.

Performing as the Navy's major test and evaluation center and test range for all air-launched/airborne weapons, targets, and related devices, the PMTC has lead or support assignments for such systems as: TOMAHAWK Cruise Missile, HARPOON air- and surface-launched missiles, F-14/PHOENIX weapon system (lead field activity), TRIDENT, SPARROW, and SIDEWINDER missile families, Advanced Medium-Range Air-to-Air Missile (AMRAAM), SHRIKE, STANDARD ARM, and HARM missile families, VANDAL target, AQM, MQM, and BQM targets, F-18 weapon system integration, Mobile Sea Range (MSR), EATS, and the Barking Sands Underwater Range Expansion (BSURE). Responding to individual external assignments, PMTC performs the following RDT&E effort:

- Test and evaluation (T&E) of naval weapons, targets, software, ground support equipment, and acceptance testing of production units;

INTRODUCTION (CONT'D)

• Technical support for Board of Inspection Surveys, integrated logistics support evaluations, engineering change proposal evaluations, contractor T&E, operational T&E, follow-on T&E, and in-service weapons T&E;

• Development or development support for range and test instrumentation systems, EW systems, weapon system tactical software, threat simulation, aircraft avionics systems, weapons ground support systems, electro-optics subsystems, and human factors systems; and

• Engineering cognizance of Fleet airborne weapons and targets for basic design engineering and data management, maintenance engineering, integrated logistics support, and production support.

As of 30 September 1987, PMTC had a budgeted civilian "managing-to-payroll" end strength of 4149 and a military allowance of 1031.

PMTC is both a Navy Industrial Fund (NIF) activity and a Major Range and Test Facility Base (MRTFB) activity. Total new funding from all sources for FY-87 was $426.1 million.

PMTC

FACILITIES

HISTORY

The Pacific Missile Test Center had its beginning in 1946 with the establishment of the Naval Air Missile Test Center (NAMTC) at Point Mugu, California. The site was selected for its weather, geography, and the availability of air and sea lanes for missile testing. In addition, the location offered the use of offshore islands, principally San Nicolas Island, for instrumentation sites. Over the years, the area between Point Mugu and San Nicolas Island, known as the Inner Sea Test Range, has become one of the most heavily instrumented areas in the world.

In 1948, a separate Naval Air Station was formed to provide airfield and base support for NAMTC. In 1958, the Pacific Missile Range was established, and in 1959 the Naval Missile Center was commissioned as a separate activity. On 25 April 1975, these organizations were consolidated. They became the Pacific Missile Test Center (PMTC) with a mandate to support the Fleet with weapon systems of proven capability.

Through its 41-year history, PMTC has added a large number of range facilities. These include track and control rooms, telemetry facilities, radars, a communication network, ordnance facilities, and target launch complexes. Collectively, they represent the best precision array for sea testing of U.S. and Allied weapon systems. Laboratories, shops, and office spaces were built to accommodate increased technological complexities and contractor participation.

In-service engineering support efforts have grown to provide on-site support to CONUS, Japan, Okinawa, Philippines, and Hawaii, and on-call support for the Atlantic and Mediterranean Fleets.

MAJOR FACILITIES AND PROPERTY

The main base of PMTC is located in Ventura County, California, at the western end of the Oxnard Plain and adjacent to the Pacific Ocean. Additional facilities include a Sea Test Range comprising an area about 125 miles wide and 250 miles long, a chain of islands (San Nicolas, Santa Cruz, Santa Rosa, and San Miguel), facilities at the Naval Construction Battalion Center, Port Hueneme, plus family housing and technical facilities at Camarillo Airport. Real estate is also leased on Santa Cruz and Santa Rosa Islands.

PMTC is also responsible for the Pacific Missile Range Facility located on Kauai and Oahu in the Hawaiian Islands. These facilities include over 900 square miles of underwater tracking capabilities at Barking Sands, Kauai.

Approximately 4,500 acres at PMTC's main base completely encompass one of the last remaining salt-water marshes on the West Coast; the one-time Indian harbor, Mugu Lagoon; and nearby Laguna Peak.

Point Mugu is near the population centers of the City of Oxnard, six miles to the northwest; the City of Camarillo, seven miles to the northeast; and the City of Los Angeles, 50 miles to the southeast. It is in close proximity to several colleges and universities, a number of which provide extension services on the main base.

Electronic warfare (EW) support efforts have grown from a vulnerability study team for airborne weapons into the technical leadership of airborne electronic warfare systems and the in-service support of the reprogrammable EW suites.

PMTC

FACILITIES (CONT'D)

	PMTC	PMRF	TOTAL
Land Owned Leased (Acres)	27,092.9	2,385.0	29,477.9
Buildings (000 SF)			
RDT&E	1,265.8	4.2	1,270.0
Administrative	370.2	24.4	394.6
Other	3,380.0	310.8	3,690.8
Acquisition Costs (Millions):			
Real Property (Classes I & II)	$196.8	$94.3	$291.1
Equipment (Classes III & IV)	$171.4	$38.7	$210.1

PMTC

PROGRAM WORK

CRUISE MISSILES

PMTC is the lead field activity for T&E on the TOMAHAWK, HARPOON, and PENGUIN weapons, which includes software support, Fleet operational support, Foreign Military Sales, and weapon station support.

AIR-TO-AIR MISSILES

PMTC is the lead field activity for T&E on the AIM-7 SPARROW, AIM-9 SIDEWINDER, AMRAAM, and AIM-54 PHOENIX programs. Included are software support, in-service engineering, second-source verification, production reliability/warranty validation, and operational test support.

AIR-TO-GROUND MISSILES

PMTC is the lead field activity for T&E on modular weapons—TOW, HELLFIRE, WALLEYE—as well as anti-radiation missiles—SHRIKE, STANDARD ARM, and HARM. Other activities on these programs include basic design engineering, production support, reliability validation, and Fleet operational support.

SURFACE WEAPONS

PMTC provides world-wide development test/operational test for the AEGIS weapon system, RAM, STANDARD Missile (SM-2), and the Close-In Weapon System. Other areas of support include scenario simulation/planning and operation of remote controlled target ships (e.g., EX-USS STODDARD).

UNMANNED AIR VEHICLES (UAV)

PMTC is the lead field activity for T&E on the PIONEER Short-Range Remotely Piloted Vehicle (RPV), AMBER, and TACIT RAINBOW systems, which includes operation of a navy Fleet Assistance Team, RPV pilot training, and Fleet operational support.

WEAPONS SYSTEM INTEGRATION

PMTC is the Software Support Activity for F-14A, F-14A+, and F-14D tactical software.

WEAPONS SYSTEM INSTRUMENTATION

PMTC has lead technical assignment for design, development, and testing of missile telemetry systems (encrypted and non-encrypted) for AIM-7 SPARROW, AIM-54 PHOENIX, TOMAHAWK, HARPOON, AMRAAM, and SM-2 BLOCK II/III. Other instrumentation systems include TOMAHAWK, airborne control/data link pods, HATS processors for SDI, and wraparound missile telemetry antennas.

TARGETS

PMTC is the lead field activity for T&E of the AQM-127A Supersonic Low-Altitude Target and the BMQ-126A Sub-Scale Target.

EA-6B SYSTEM DEVELOPMENT AND SUPPORT

PMTC is the lead field activity for software support. Development and support includes the Tactical EA-6B Mission Support (TEAMS), EA-6B Weapons Systems Support Lab (WSSL), and EA-6B Software Support Activity (SSA).

PROGRAM WORK (CONT'D)

TRIDENT MISSILE SYSTEM

PMTC is the lead field activity for Pacific range support for the TRIDENT I C4 Program. The Strategic Systems Program Office and PMTC have developed a TRIDENT missile test instrumentation system to support operational tests in the Pacific.

F-18

PMTC is cognizant field activity for the LAU-7/A5 launcher, and is tasked to identify the extent of incompatibility of an aircraft/launcher/missile. Completed aircraft flight testing with the launcher and follow-on laboratory tests continue.

RANGE SUPPORT AND FIELD OPERATIONS

PMTC is the lead field activity for range instrumentation development—operating and maintaining a major test range for weapon systems and missile and space vehicle T&E; and providing range services for Fleet exercises.

V-22A

PMTC has lead technical assignment for defining and testing the Joint Services Vertical Lift Experimental Aircraft EW suite.

ELECTRONIC WARFARE (EW) SYSTEMS

PMTC is lead field activity for development, testing, and support of EW software; technical lead for airborne countermeasures systems.

PMTC

MAJOR ACCOMPLISHMENTS
FY-86

TOMAHAWK

Provided support to TOMAHAWK operational launch in the Aleutian Islands. Supported electromagnetic vulnerability testing of TOMAHAWK BGM-109A missile in front of a SPY-1 radar. Designed and constructed sophisticated system to measure the electric field strength and radar pulse form of missile while testing.

FLEET SUPPORT

Provided software changes and hardware support for TERPES, which accompanied VMAQ-2 Det Y aboard USS AMERICA on its deployment to the Mediterranean. Completed a UDF update of the EW Avionics on board the A-7E aircraft both on the East Coast and in the Mediterranean. This was first full-scale UDF update accomplished under the EWSSA charter at PMTC.

AIR-LAUNCHED MISSILE READINESS

Achieved, for first time, the CNO air-launched missile asset readiness objective of 86%. Commenced delivery of LAU-7/A-6 SIDEWINDER Guided Missile Launchers to Fleet units.

CTX 86-1/RDX 86-1

Completed CTX 86-1 with 10 participating ships firing nine missiles against 11 targets. Completed RDX 86-1 with 18 participating ships firing 15 missiles against various threats.

HARPOON

Completed HARPOON OPEVAL, including multiple launch scenarios against three target ships.

AMRAAM

Conducted first Navy launch of AMRAAM missile. Completed AMRAAM ACE-2 integration testing and the first flight test on the F/A-18 aircraft.

AIRBORNE SELF-PROTECTION JAMMER SYSTEM (ASPJ)

Completed the most complex series of tests ever performed with an ECM system. Conducted five months of tests (using PMTC's Tactical Environmental Simulator facility) and three months of double-shift tests at the AF Electronic Warfare Evaluation Simulator against 9 threat systems in high-density multiple-signal environments.

AIM-54/F-14 PHOENIX

Completed design/test of F-14A Tactical Tape 114A for Fleet release. Conducted first-ever quadruple QF-86 unmanned target presentation in support of PHOENIX testing.

RECOGNITIONS

Selected by SECNAV as a participant in the Model Installation Program.

Presented with the 1986 Secretary of Defense Natural Resources Conservation Award.

PMTC achieved 5 years and over 32,000 hours of Class A mishap-free flight operations; NAS had 7 years and over 15,000 hours; and PMRF HAWAII had 15 years and over 24,000 hours.

PMTC celebrates its 40th anniversary! 1946-1986

PMTC

MAJOR ACCOMPLISHMENTS
FY-87

CRUISE MISSILES

Conducted first ship launch of TOMAHAWK submunition variant from USS ARKANSAS. TLAM surface and sub-surface launches were supported with mission routes up to 400 miles, terminating at two sites—NWC China Lake and San Clemente Island. Completed development test (DT) and operational test (OT) of HARPOON Dash 4 seeker consisting of 7 launches from A-6E, P-3A, SSN, and DDG platforms. Completed PENGUIN Master Test Plan.

AIR-TO-AIR MISSILES

Completed five launches, 19 Goldenbird captive flights, and 79 simulation cases during evaluation of AIM-7 SPARROW H-Build software. Completed AIM-9 SIDEWINDER warranty testing for 15 production lot samples (13,500 missile test hours). Accomplished all AMRAAM test launches and HIL simulations required to support DARB decision on limited production. Achieved AMRAAM TAAF goal of 8,000 missile test chamber hours. Completed AIM-54C PHOENIX DT IIIB while support continues for OPTEVFOR on OT IIIB. Developed PHOENIX Software Configuration Management Plan, which was subsequently approved by NAVAIR. Hosted the technical source selection team for AAAM.

AIR-TO-GROUND WEAPONS

Completed 2,279 hours of combined environment reliability testing on 16 HARM missiles. Produced and delivered 60 inert SHRIKE warheads for USAF. Completed construction of 5 STANDARD ARM pods for VA-165.

30 SEPTEMBER 1987

SURFACE WEAPONS

The Japanese Defense Force conducted operational evaluation on a Shore-to-Ship Missile (SSM-1) at PMTC, with over 100 Japanese military and civilian personnel taking part in the testing of 8 launched missiles. Completed DT/OT II of the Rolling Airframe Missile (RAM) with 10 firings from the USS DAVID R. RAY and San Nicolas Island. Conducted first dual VANDAL target presentation in support of AEGIS DT/OT. Supported AEGIS operations at three locations—PMTC, PMRF Barking Sands, and Puerto Rico.

UAV

Completed "Quick Go" program of PIONEER Short-Range Remotely Piloted Vehicle (RPV), including flights tests from the USS IOWA. Completed preparations for TACIT RAINBOW environmental and EMI tests. Conducted AMBER demonstration flights at UTTR.

WEAPONS SYSTEM INTEGRATION

Completed development and testing of F-14A+ Tapes 114B1/P14B1 with limited release to Grumman. Activated F-14D Detachment at Grumman Aerospace facilities at Long Island, NY. Commenced F-14D radar development flights in the TA-3B test bed aircraft, and initiated F-14D Software Support Activity (SSA) build-up.

WEAPON SYSTEM INSTRUMENTATION

Conducted Preliminary Design Review (PDR) for the PMTC-developed AN/DKT-53X telemeter. Subsequently, approval of the design was received. Began integration testing at Hughes on the PMTC-developed AMRAAM warhead-compatible tactical telemeter. The last of 275 PMTC-designed and produced AN/DKT-61 telemeters were delivered.

PMTC

MAJOR ACCOMPLISHMENTS (CONT'D)
FY-87

TARGETS

Air-launched and flew, for the first time, a BQM-34S target using the Extended Area Test System (EATS) to relay ITCS command and control—this test was a significant milestone in the development of ITCS/EATS/BQM-34S interface. Conducted first nine test flights of BQM-126A. Completed six of eight planned AQM-37C Extended Performance (EP) missions where flight parameters included Mach 4 at 100,000 feet. Developed a dual VANDAL Target presentation capability and conducted a successful dual flight operation.

TRIDENT

Supported a TRIDENT System Readiness test using a P-3 aircraft to simulate the actual broach (launch) of a TRIDENT I C4 missile and an F-14 aircraft to simulate the first stage of missile flight.

AIRBORNE TELEMETRY SYSTEM

The Naval Regional Contracting Center, Long Beach, advised that the Airborne Telemetry System contract was awarded to LTV, Aerospace and Defense, Buffalo, NY.

CYBER 860A/175

Achieved operational status on our second CYBER 860A. One computer is configured for batch support and the other is configured for interactive support. In addition, we have two CYBER 175s configured for range real-time operational support. Improved batch throughput and interactive user response time has resulted in the CYBER 175s now handling the range operations real-time data processing workload with increased graphics presentations, on-line storage, and Xerox tab output for range users.

EA-6B SYSTEM

The EA-6B System Software Support Activity (SSSA) released for Fleet use two software products, the SSA-1 Operational Flight Program for the on-board EA-6B tactical computer systems and the companion Tactical EA-6B Mission Support (TEAMS) Version 2.8. These two products gave the Fleet significant enhanced abilities to record and reduce mission data. The TEAMS program gives Fleet operators an on-board, world-wide parametric data set for the first time.

RDT&E OPERATIONAL SUPPORT

Deployed the STARCAST system on the DOD Pony Express missions in the South Pacific, which successfully gathered Optical data on assigned targets. Performed laboratory integrity and integration tests for Airborne Self-Protection Jammer at PMTC and promulgated final report. The flight load User Data Files and the Operational Flight Program were validated and the approved software, along with the associated documentation, was forwarded to NWC China Lake, Eglin AFB Florida, and the Air Force Electronic Warfare Environment Systems Laboratory Fort Worth, for further testing.

CAPABILITY DEVELOPMENT/ENHANCEMENT

Enhanced Radar Cross Section (RCS) measurements capability by adding a digitizing table that translates target drawings to construction data for 3D models and computer images, high-resolution graphics for producing 3D images of RF antenna patterns, and interactive color graphics for displaying target RCS as a function of frequency and aspect angle.

PMTC

MAJOR ACCOMPLISHMENTS (CONT'D)
FY-87

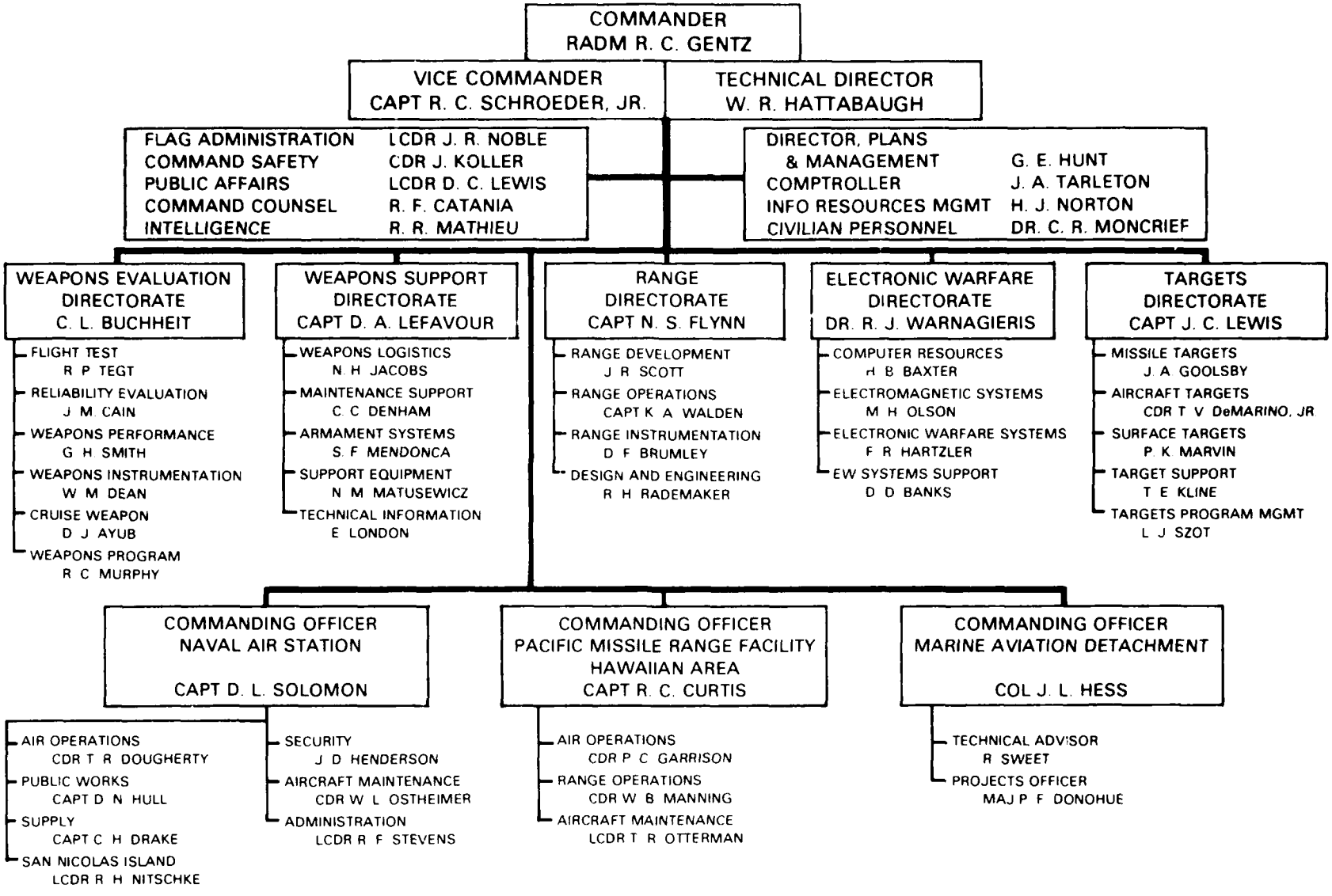
Completed installation of Fleet Satellite Communication system at PMRF Barking Sands to support future AEGIS testing.

Submitted to NAVAIR/OPNAV a proposal for a joint PMTC/ NATC 6.2 T&E exploratory development block-funded program.

OPNAV (OP-507) endorsed and forwarded to OP-982 for approval a PMTC-proposal for a dedicated ARM target ship (EX-USS PARSONS).

Completed the 100 percent design review for MILCON P-986 (Missile Simulation/Radar Cross Section Facility) with construction anticipated to begin in FY-89.

PACIFIC MISSILE TEST CENTER ORGANIZATION



30 SEPTEMBER 1987

PMTC

PERSONNEL DATA
(PMTC, NAS, PMRF)

ON BOARD

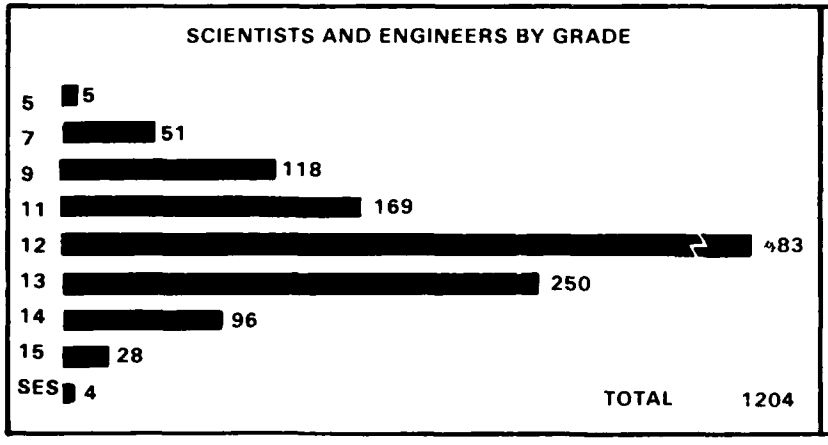
TOTAL ON BOARD	TOTAL MILITARY	OFFICER	ENLISTED	TOTAL CIVILIAN	TOTAL FTP	TPTI	FTP UNGRADED	FTP GRADED
5179	962	127	835	4217	4090	127	658	3432

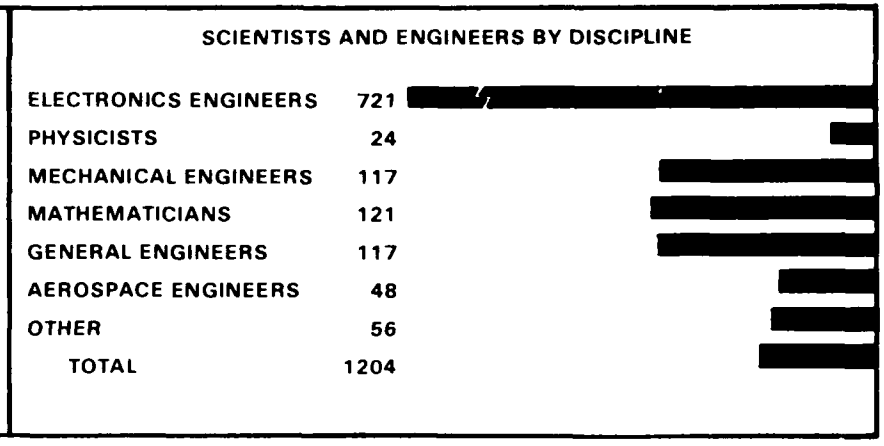
AUTHORIZED POSITIONS/ALLOWANCE

CIVILIAN	4149
MILITARY	1031
OFFICER	177
ENLISTED	854
TOTAL	5180

FTP GRADED

SCIENTISTS AND ENGINEERS	1204
ADMINISTRATION	839
TECHNICIANS	980
OTHER	409
TOTAL	3432





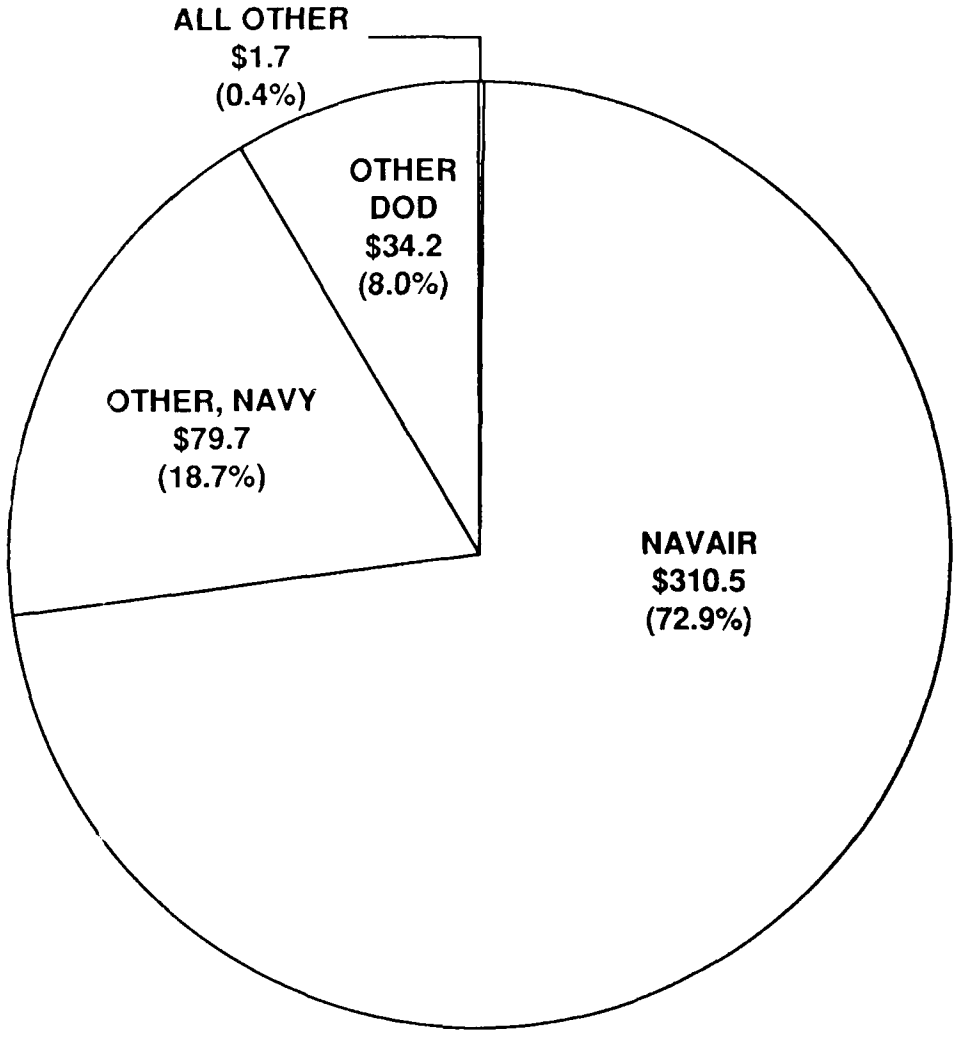
30 SEPTEMBER 1987

PMTC

FUNDING BY SPONSOR

FY87 - ACTUAL ($M)

NOR



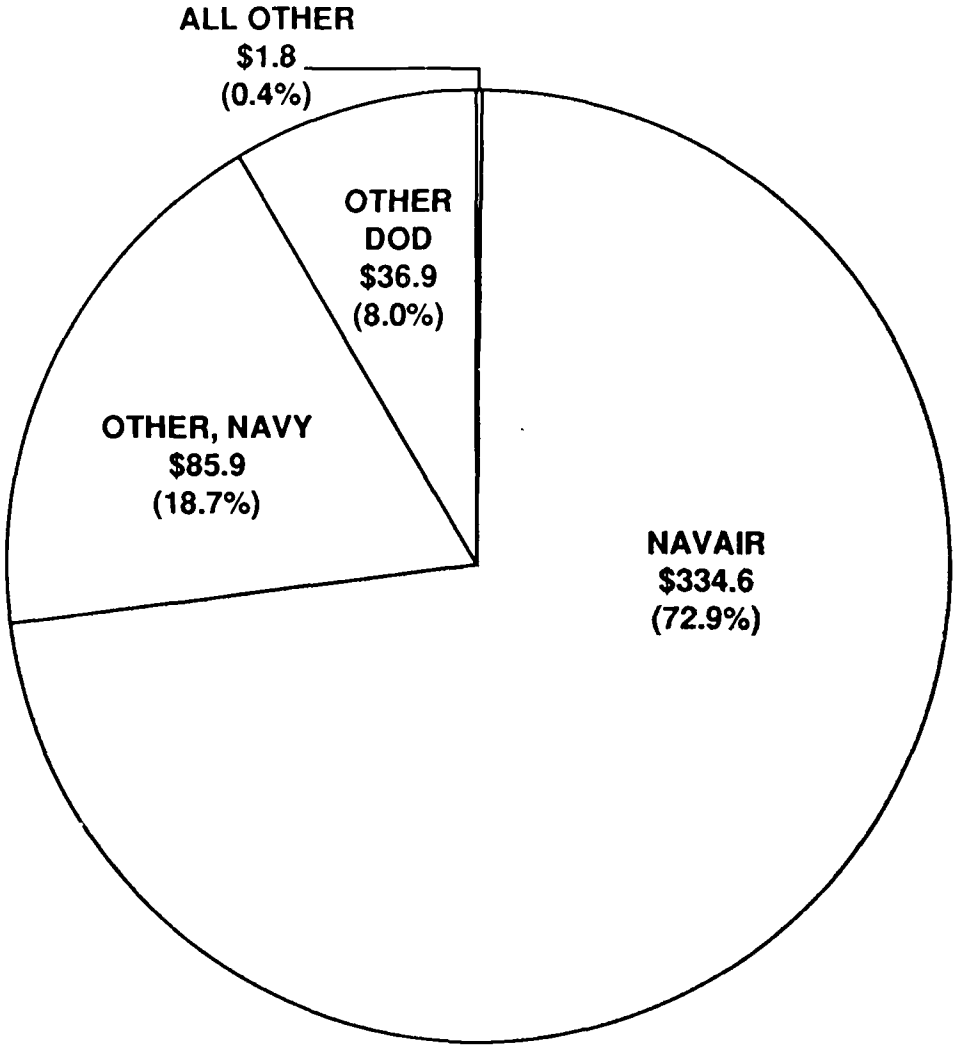
30 SEPTEMBER 1987

PMTC

FUNDING BY SPONSOR

NOR

FY88 - ESTIMATE ($M)



TOTAL $459.2

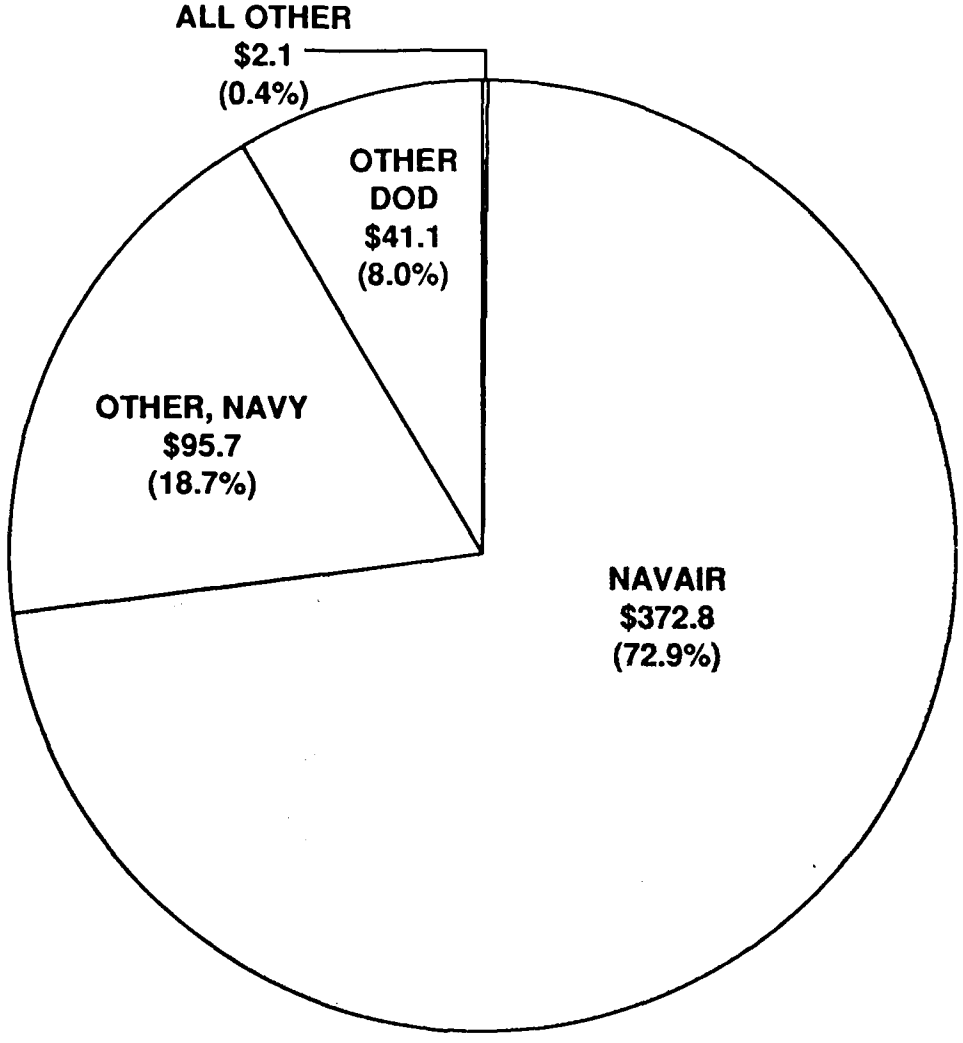
30 SEPTEMBER 1987

PMTC

FUNDING BY SPONSOR

NOR

FY89 - ESTIMATE ($M)



TOTAL $511.7

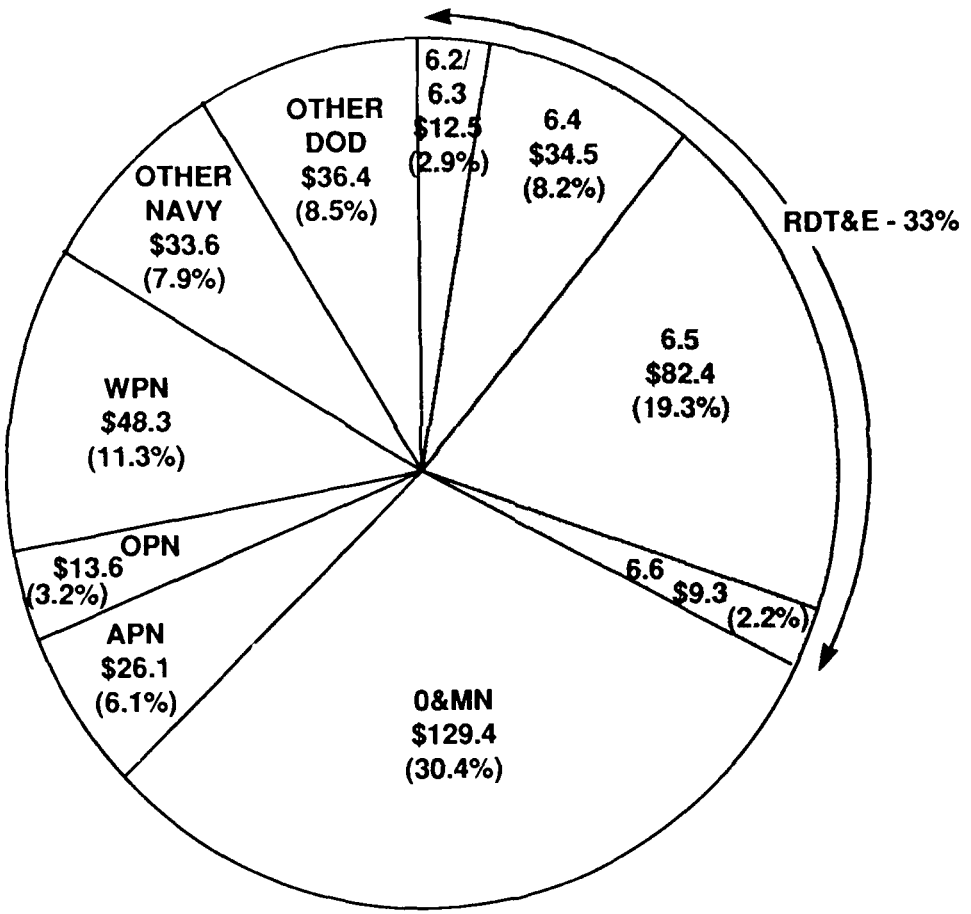
30 SEPTEMBER 1987

PMTC

FUNDING BY APPROPRIATION

FY87 - ACTUAL ($M)

NOR



30 SEPTEMBER 1987

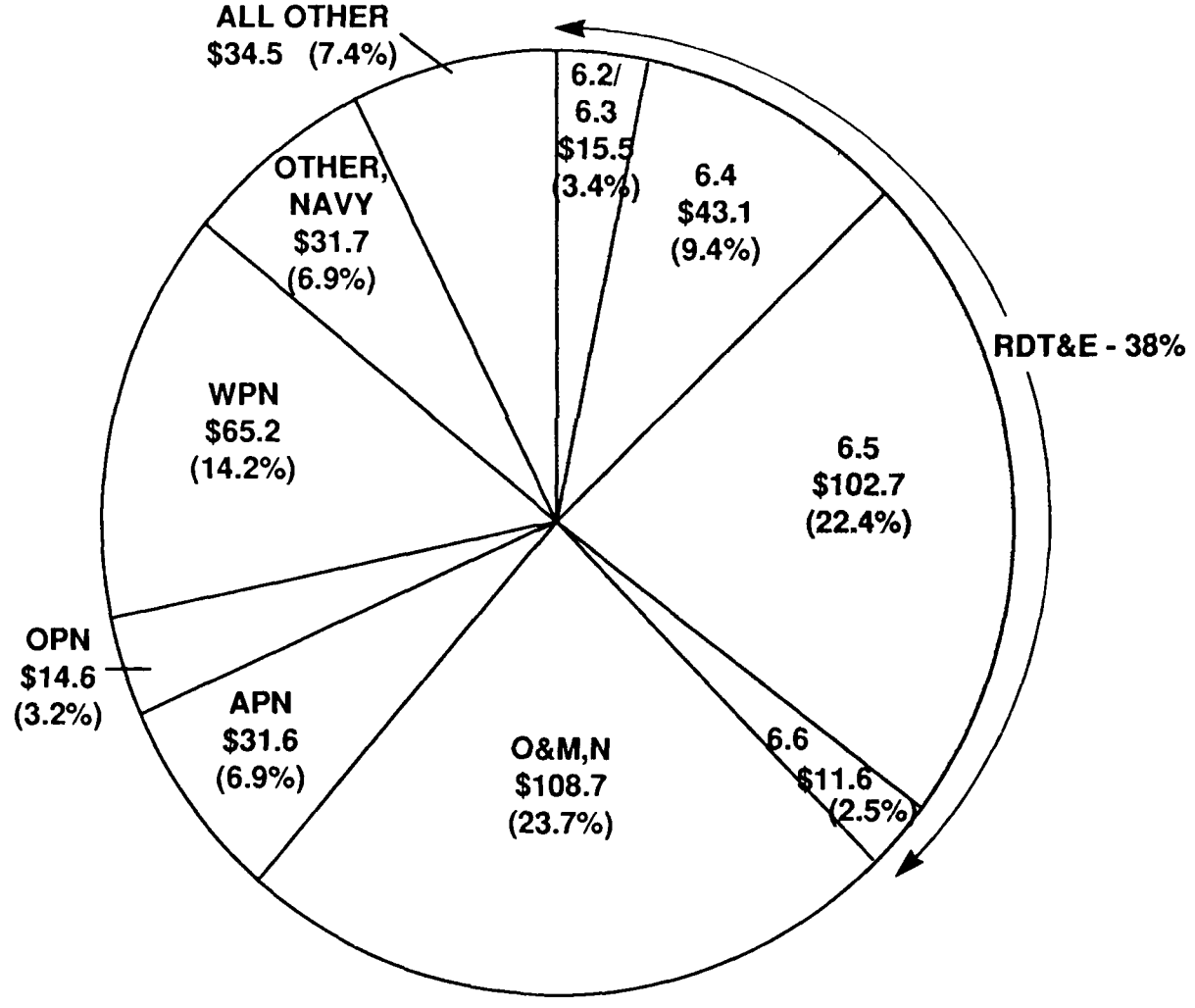
TOTAL $426.1

PMTC

FUNDING BY APPROPIATION

NOR

FY88 - ESTIMATE ($M)



TOTAL $459.2

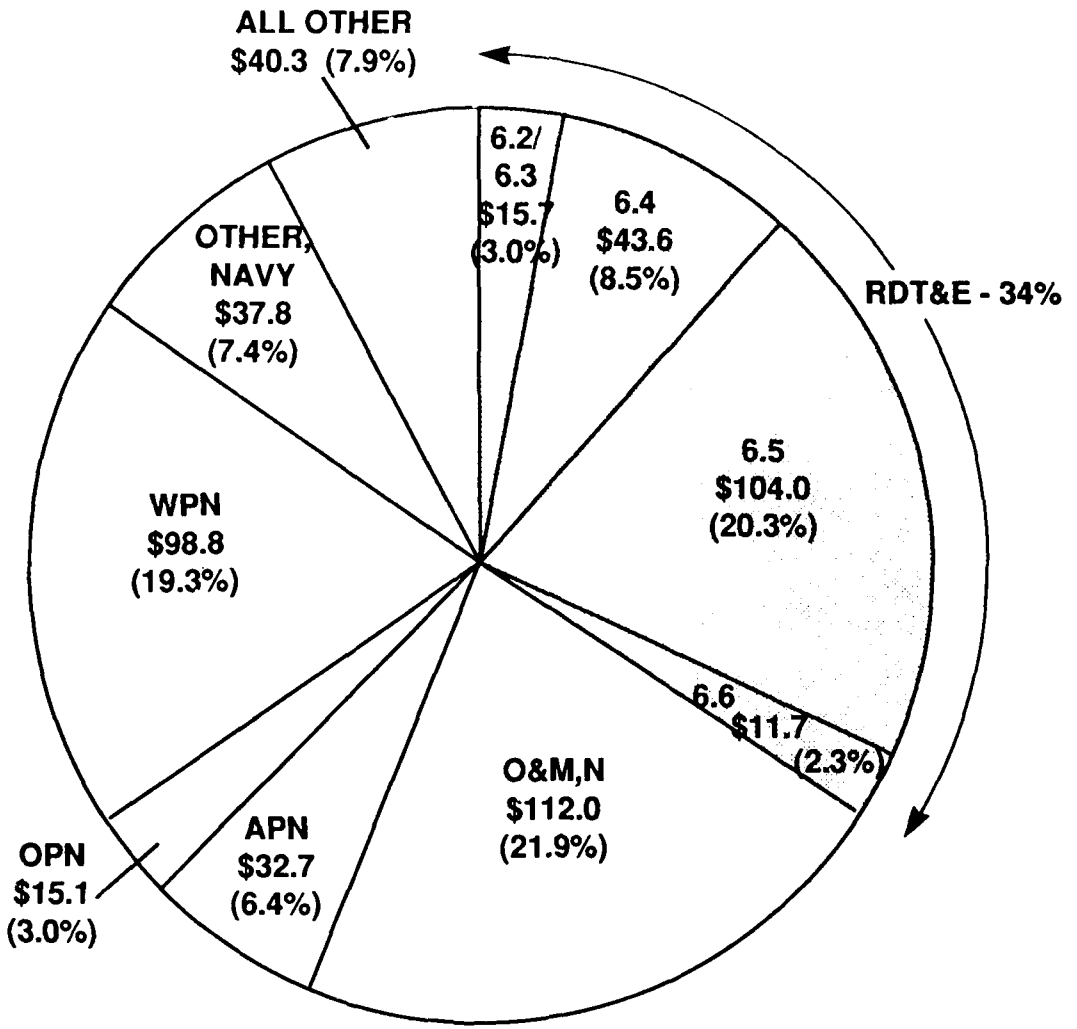
30 SEPTEMBER 1987

PMTC

FUNDING BY APPROPRIATION

NOR

FY-89 - ESTIMATE ($M)



30 SEPTEMBER 1987

TOTAL $511.7

PMTC

FUNDS BY CATEGORY AND TYPE
($M)

NOR

CATEGORIES & TYPE	FY-87			FY-88			FY-89		
	$M ACTUAL	% OF RDT&E	% OF TOTAL	$M ACTUAL	% OF RDT&E	% OF TOTAL	$M ACTUAL	% OF RDT&E	% OF TOTAL
RDT&E									
6.1 RESEARCH	-	-	-	-	-	-	-	-	-
6.2 EXPLORATORY DEVELOPMENT	1.4	1.0	.3	1.7	1.0	.4	1.7	1.0	.3
6.3 ADVANCE TECHNOLOGY	11.1	8.0	2.6	13.8	8.0	3.0	14.0	8.0	2.7
SUBTOTAL	$12.5	9.0	2.9	$15.5	9.0	3.4	$15.7	9.0	3.0
6.4 ENGINEERING DEVELOPMENT	34.5	24.9	8.2	43.1	24.9	9.4	43.6	24.9	8.5
6.5 MANAGEMENT SUPPORT	82.4	59.4	19.3	102.7	59.4	22.4	104.0	59.4	20.3
6.6 OPERATION SYSTEM DEVELOPMENT	9.3	6.7	2.2	11.6	6.7	2.5	11.7	6.7	2.3
SUBTOTAL	$126.2	91.0	29.7	$157.4	91.0	34.3	$159.3	91.0	31.1
RDT&E TOTAL	$138.7	100.0%	32.6%	$172.9	100.0%	37.7%	$175.0	100.0%	34.1%
OTHER APPROPRIATION									
(O&MN) OPERATION & MAINTENANCE (NAVY)	129.4		30.4	108.7		23.7	112.0		21.9
(APN) AIRCRAFT PROCUREMENT (NAVY)	26.1		6.1	31.6		6.9	32.7		6.4
(OPN) OTHER PROCUREMENT (NAVY)	13.6		3.2	14.6		3.2	15.1		3.0
(WPN) WEAPONS (NAVY)	48.3		11.3	65.2		14.2	98.8		19.3
OTHER NAVY	33.6		7.9	31.7		6.9	37.8		7.4
ALL OTHER	36.4		8.5	34.5		7.4	40.3		7.9
OTHER TOTAL	$287.4		67.4%	$286.3		62.3%	$336.7		65.9%
GRAND TOTAL	$426.1		100.0%	$459.2		100.0%	$511.7		100.0%

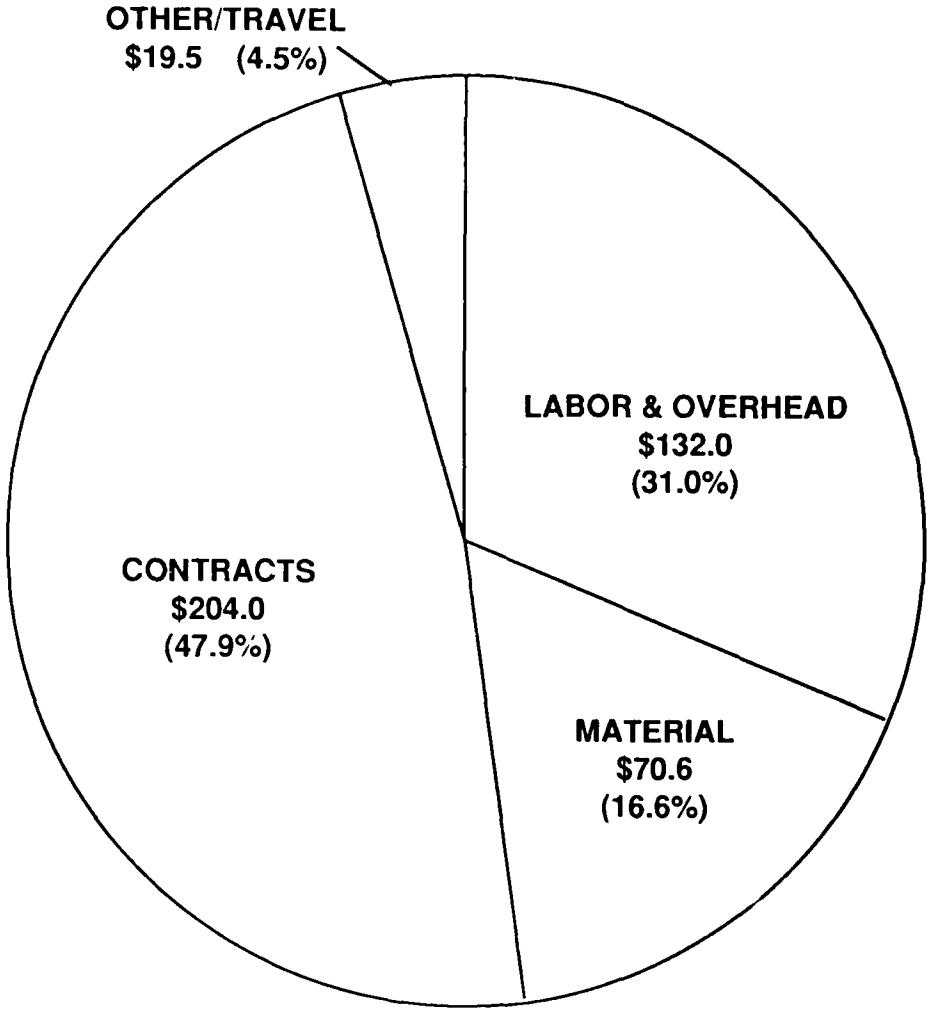
30 SEPTEMBER 1987

PMTC

DISTRIBUTION OF FUNDS

NOR

FY87 - ACTUAL ($M)



30 SEPTEMBER 1987

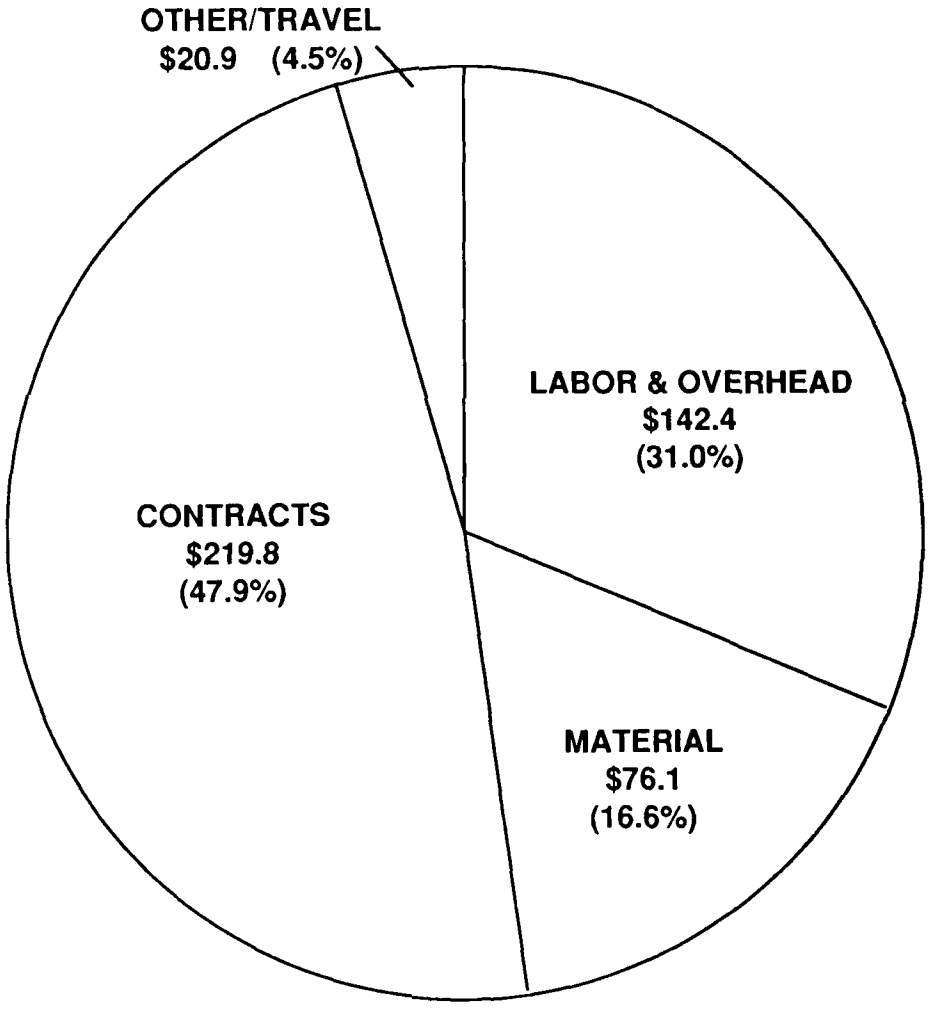
TOTAL $426.1

PMTC

NOR

DISTRIBUTION OF FUNDS

FY88 - ESTIMATE ($M)



TOTAL $459.2

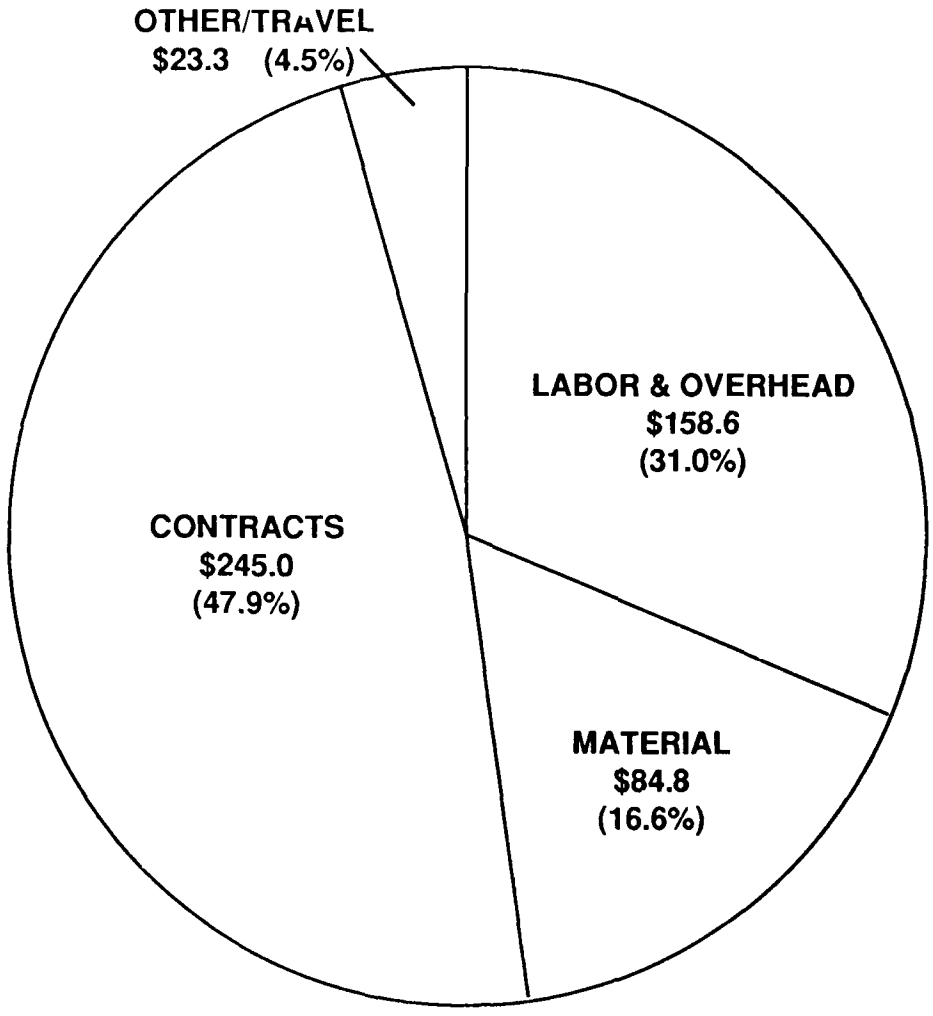
30 SEPTEMBER 1987

PMTC

DISTRIBUTION OF FUNDS

FY-89 - ESTIMATE ($M)

NOR



30 SEPTEMBER 1987

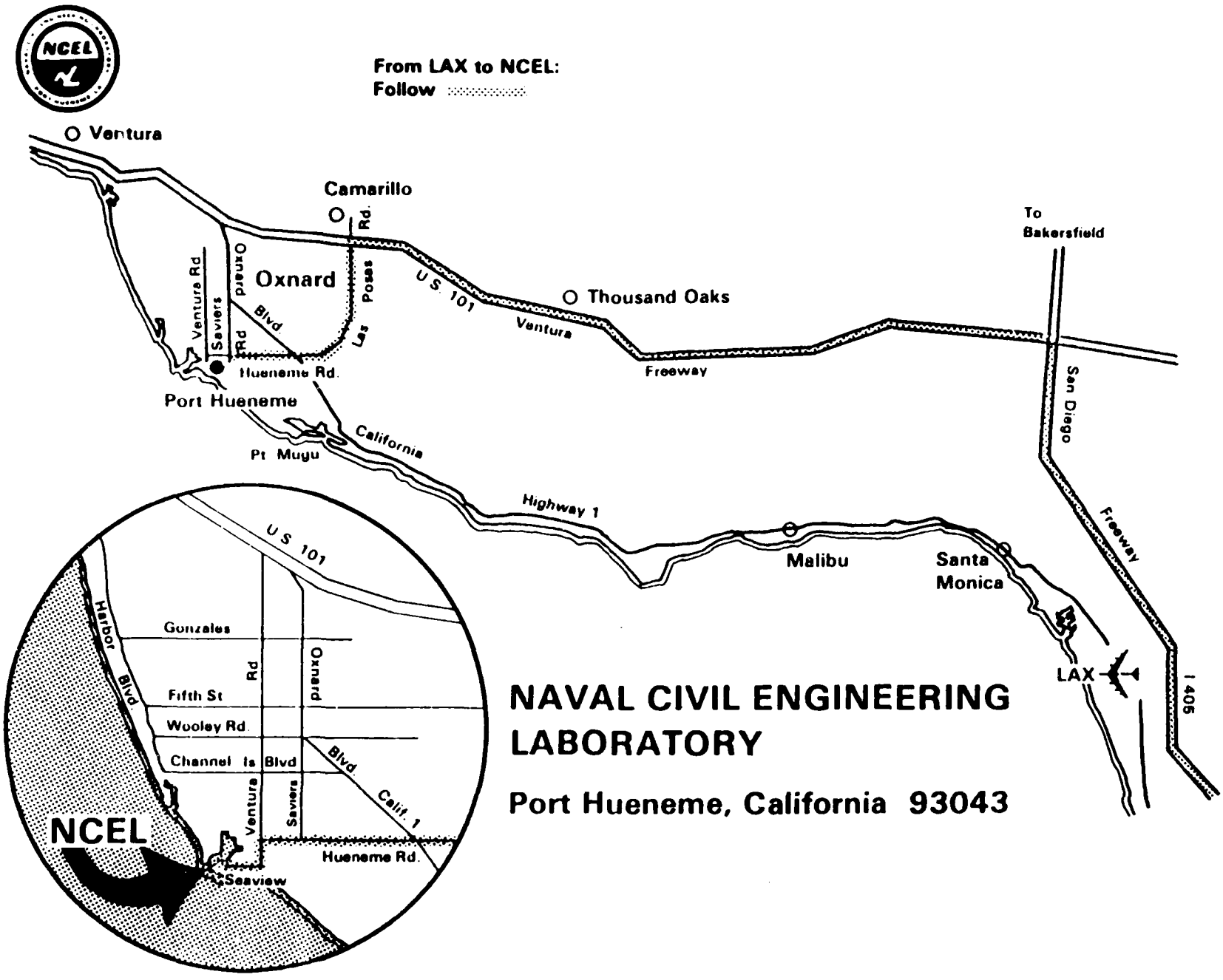
TOTAL $511.7

PACIFIC MISSILE TEST CENTER
POINT MUGU, CALIFORNIA

NAVAL CIVIL ENGINEERING LABORATORY BRIEF

CAPT D.R. WELLS
COMMANDING OFFICER

R.N. STORER
TECHNICAL DIRECTOR



NAVAL CIVIL ENGINEERING LABORATORY

Port Hueneme, California 93043

30 September 1987

MISSION

TO BE THE PRINCIPAL NAVY RDT&E CENTER FOR SHORE AND FIXED SURFACE AND SUBSURFACE OCEAN FACILITIES AND FOR THE NAVY AND MARINE CORPS CONSTRUCTION FORCES

30 September 1987

INTRODUCTION

At the outbreak of World War II, the Bureau of Yards and Docks established research and test facilities to provide solutions to its engineering problems. Shortly after Pearl Harbor, testing of commercial equipment for the newly organized Naval Construction Battalions was undertaken at various activities including the Naval Civil Engineering Laboratory (NCEL) which was established at Solomons, Maryland in 1942.

In 1950, the Laboratory was relocated to Port Hueneme, California, to provide a site with better physical facilities for equipment evaluation, and one closer to a proving ground. During the 1950's and 1960's, there was a general trend away from equipment evaluation and more emphasis placed on the research and development of shore facilities equipment and engineering techniques. During the 1970's, the Laboratory continued its pattern of growth, broadening the variety of programs with the addition of environmental and energy work, developing new facilities and showing a steady increase in funding from NAVFAC and other sources.

In January 1974, NCEL was disestablished as a NAVMAT Laboratory, reestablished as the Civil Engineering Laboratory (CEL) and placed under the direction of the Naval Facilities Engineering Command as a detachment of the Naval Construction Battalion Center, Port Hueneme. On July 1981, the Naval Civil Engineering Laboratory was recommissioned as an independent shore activity. The Naval Facilities Engineering Command was delegated authority for command and support of NCEL.

Historically the predominance of funding has been in the Exploratory Development category. In recent years, the Laboratory has changed from a technology-based development organization to a full-spectrum laboratory, capable of producing operational systems for use by the Fleet.

At the end of FY86, NCEL employed 380 civilians plus 18 military personnel. Two hundred thirteen of the civilians and eight of the military were engineers and/or scientists.

Total funding for FY86 was $45.4 million of which over 51% was received from the Naval Facilities Engineering Command. Estimated funding for FY87 is approximately $52 million.

NCEL encompasses 32 acres and is located adjacent to the deepwater harbor of Port Hueneme, California, which is approximately 65 miles northwest of Los Angeles. Real property and equipment assigned to the Naval Civil Engineering Laboratory have a plant account value of $7.3 million.

FACILITIES

NCEL SPACE AND PROPERTY

LAND - NAVY OWNED:	32.23 ACRES
BUILDINGS:	
RDT&E	112,965 SF GROSS
ADMINISTRATIVE	77,463 SF GROSS
OTHER	16,493 SF GROSS
ACQUISITION COSTS:	
REAL PROPERTY (CLASSES I & II)	$3.0 MILLION
EQUIPMENT (CLASSES III & IV)	$4.6 MILLION

30 September 1987

MAJOR FACILITIES

ADVANCED ENERGY UTILIZATION TEST BED - This facility is designed for use in evaluating integrated energy research efforts including solar heating systems, wind power, heating, ventilation and air conditioning equipment, construction materials and techniques, lighting, and infra-red imaging, heat flux and infiltration instrumentation.

APPLIED MECHANICS LABORATORY - The Applied Mechanics Laboratory provides a capability for experimental work in the thermal sciences as well as solid and fluid mechanics. Current work emphasizes energy conservation systems, natural ventilation and infiltration studies, multiphase flow, energy conversion, and shock, vibration, and noise studies. It includes a low velocity wind tunnel, a blower duct facility, a steam equipment test area, and shock and vibration test equipment together with data acquisition and processing equipment for laboratory and field testing.

BIOLOGY LABORATORY - This Laboratory is equipped to conduct both micro and macro studies. Present investigations include work on marine microoganisms, borers and fouling organisms, and the control of mildew growth at tropical and subtropical locations.

CHEMISTRY LABORATORY - This facility supports the entire laboratory program including corrosion control, formulation and evaluation of protective coatings, and development of practical, economical fuel tank liners and insulating roofing materials.

DEEP OCEAN SIMULATION LABORATORY - Contains a total of 12 high-pressure vessels capable of simulating the ocean environment under controlled conditions. This laboratory supports NCEL's ocean engineering programs. The pressure vessels range in size from 5 to 72 inches in diameter, and they can duplicate pressure, temperature, pH, salinity, oxygen content and chemical content of seawater at any depth.

DIVING LOCKER - The Seabee Diving Locker supports the ocean engineering program. It is a versatile underwater operation equipped to handle practically any task NCEL engineers take from the drawing board to ocean testing. The skilled diving team assists in underwater RDT&E evaluations pertaining to anchors, underwater tools, inspection, and underwater electrical systems.

ELECTRICAL SYSTEMS LABORATORY - A fully equipped laboratory to support shore facilities R&D programs, equipped to evaluate and test specialized electrical and electronic circuits. The Laboratory operates a test center, complete with auxiliary power supplies and load banks, that evaluates performance of electrical equipment. Specialized diagnostic instrumentation is available for analysis and simulation of power transient phenomena.

MAJOR FACILITIES (CONTINUED)

ELECTROMAGNETIC COMPATIBILITY LABORATORY - Houses a high-voltage generator and an internal experimental shielded room 20 by 20 ft in a 50 by 100 ft shielded building. The high-voltage generator is used for antenna insulator studies and the building and internal shielded room are used for radiowave shielding and filtering studies.

ENVIRONMENTAL PROTECTION LABORATORY - Developed/equipped for RDT&E in oily waste disposal, oil spill removal; sanitary conversion and disposal; water decontamination and purification; solid waste refuse-derived fuel analysis including drying ovens, screens, grinding mill, and bomb calorimeter; noise and air pollution abatement, hazardous waste treatability and land use management at Navy shore facilities and advanced bases; and other pollution control and abatement requirements identified by changing standards.

HYDRAULICS PROTECTION LABORATORY The purpose of this laboratory is to test and evaluate hydraulic equipment in support of underwater construction operations. It contains high-pressure seawater and oil hydraulic test benches; instrumentation and microcomputers for test and analysis of pumps, motors, and valves; and specialized assembly tools and cleaning stations.

MATERIALS LABORATORY - The Materials Laboratory is equipped to handle problems in organic chemistry as well as general analytical, physical and inorganic chemistry. Areas of investigation include organic coatings, plastics, metals, alloys, concrete, composite materials, chemical problems related to environmental protection and many miscellaneous problems.

METALLURGY LABORATORY - The laboratory is equipped to identify and characterize materials to correlate composition and structure (metallurgical) with physical and chemical properties such as strength, fatigue, resistance, and corrosion. Failure mechanisms in components are determined that failed in service. A scanning electron microscope with X-ray analyzer provides capabilities in both R&D and failure analysis.

OPTICAL METROLOGY LABORATORY (Formerly Photoelastic Laboratory) - This laboratory is equipped for conducting optical mechanics studies of stress, strain, and deflection. Two- and three-dimensional photoelastic studies can be conducted including static and dynamic analyses. Laser based capabilities include holography, interferometry, scattered light, and remote deflection sensing with field application on dynamic and inaccessible structures.

PAVEMENT LOADING FACILITY - This is a load reaction trailer with a hydraulically operated

MAJOR FACILITIES (CONTINUED)

ram for applying loads up to 100,000 pounds to pavements, bases, and subgrades to determine their load-carrying capacity. The trailer uses water for ballast.

PHYSICAL SECURITY APPLIED RESEARCH LABORATORY- This laboratory performs RDT&E on internal and external security systems for facilities including weapons storage magazines and secure facilities. It includes a research building for breadboarding and testing various hardware systems, a ballistic range for testing ballistic-resistant hardware up to .30 calibre and an End-Wall Door Simulator for testing full-scale security hardware and construction for storage magazines.

POLAR LABORATORY - Provides a year-round facility to develop fundamental information on ice, snow, and other materials associated with transportation, construction and operation problems at polar sites. It also provides a facility for performance tests on components and small equipment for training field personnel prior to deployment.

PROTECTIVE COATINGS TEST FACILITIES - These facilities consist of a Coating Application Laboratory, a Corrosion Dock for tidal exposure of test panels in the harbor, and a pier with test racks for atmospheric exposure. Test racks for atmospheric exposure are also located at Kaneohe, Hawaiian Islands; China Lake, California; and at Kwajalein, Marshall Islands.

SHALLOW WATER DIVE TANK FACILITY - Used to support ocean engineering activities such as the testing of oceanographic equipment, diver construction techniques, diver tools, underwater non-destructive inspection equipment, and short-term environmental studies. It is 30 feet in diameter, 12 feet high, and is filled with 65,000 gallons of seawater. The facility is equipped with a 2-ton capacity overhead crane and a topside observation deck. Viewing windows are located in the side walls, two of which are hemispherical and open into a weather protected instrumentation room. Diver communications, automatic data acquisition and processing, and videotape facilities are available. Additionally, the tank is used for predeployment check-out of large pieces of equipment, for determining proper buoyancy and proper functioning of electrical and hydraulic systems, and for developing deployment/recovery techniques.

SOIL LABORATORIES - NCEL has two soil laboratories, the Seafloor Soils Laboratory, and the Soil Mechanics Research Laboratory.

SEAFLOOR SOILS LABORATORY - This laboratory provides a facility for classifying and determining the engineering properties of seafloor soil samples for use in foundation and anchor design. It contains standard equipment for measuring soil water content, grain size, grain density, Atterberg limits, and carbonate and organic carbon content. Special equipment, vane sheet, modified triaxial shear and one-

MAJOR FACILITIES (CONTINUED)

dimensional compression devices, are available for measuring engineering properties.

SOIL MECHANICS RESEARCH LABORATORY - Equipment and facilities are available to conduct research and evaluation in soil mechanics, foundations, and pavements. Included are facilities for identification and classification tests on soils and aggregates; and for study of such properties as direct shear strength, triaxial shear strength (static and cyclic), consolidation, unconfined compression, compaction characteristics, California Bearing Ratio (CBR) values, as well as facilities for extracting asphalt from pavement specimens, for testing and identifying asphalts, and for designing and testing asphalt pavement mixtures.

PROGRAM WORK

As the principal research, development, test and evaluation center for shore facilities, fixed surface and subsurface ocean facilities, and the Navy and Marine Corps Construction Forces, the Naval Civil Engineering Laboratory's special thrusts are directed toward the following technical areas:

OCEAN FACILITIES

Ocean facilities encompasses all RDT&E aspects relating to the design, construction, installation, inspection, maintenance and repair of fixed surface and subsurface ocean structures.

Special focus has been placed on the following:

a. Seafloor engineering including geotechnical engineering, foundations, anchors, nearshore sediment processes and site survey. Current work includes development and calibration of ballistic soil type and strength probes. Projected products include air-dropped ballistic soil probes and recoilless propellant embedded anchors.

b. Moorings, suspended cable structures, and bottom-laid cable and pipeline systems. Current work includes deep ocean lift system design, studies of synthetic line fatigue life, and development of installation and handling methods for fiber optic-based cable arrays.

c. Manned and unmanned structural systems including relocatable facilities, long term sensor platforms and underwater terrorist protection systems. Current work includes experiments which will ensure a reliable and efficient design for Offshore Technical Air Combat Training Systems and provide a computer-aided analysis capability for moored vessel responses to wind, current, and waves.

d. Remote and diver-operated construction work systems. Current work includes Arctic Ocean construction systems, development of the seawater hydraulic multi-function tool system, diver lift system, cable tracking system, metal detection system, and modular contingency platforms for Underwater Construction Teams.

SHORE FACILITIES

This product area provides the technology and capability required to plan, design, construct, and maintain an effective shore establishment in order to support the operational readiness of the Fleet.

The achievement of this technology and capability will result in effective and economical Fleet support in peacetime, flexibility to cost-effectively meet large changes in number and type of Fleet units being supported for redeployments and contingencies, readiness and reliability to support mobilization efforts and to provide rapid logistics support, and enhanced survivability of mission critical facilities in time of war.

PROGRAM WORK (CONTINUED)

Accomplishments of the objective of this program will require developing a technology base in each of the following technical areas so that future required operational capabilities of the Navy can be met:

a. Utilities Technology. Meet future requirements of Navy utility systems and provide safe, reliable, cost-effective and efficient operation of utility equipment and systems. Pierside shore-to-ship utilities improvements and electromagnetic shielding currently have the highest priority.

b. Facility Diagnostics. Insure that the condition of Navy facilities permits adequate support for a high level of Fleet operational readiness at minimum possible cost through capabilities to assess facilities condition and remaining useful/safe life, extend service life, control or eliminate imminent structural failures and safety hazards, and use new maintenance methods, materials and strategies.

c. Physical Security Technology. Develop new concepts in security engineering and technology as a means of providing the Navy with improved capabilities for reliably and cost-effectively protecting its assets from loss or damage resulting from theft, vandalism, sabotage or other deliberate unauthorized acts.

d. Structures Technology. Reduce design and construction costs of structures and facilities that support operational readiness of new weapons platforms and systems, including a cost-effective use of life-cycle concepts and improved safety. Currently, the development of criteria and analysis tools to mitigate the seismic hazard risk are being emphasized.

e. Materials Technology. Develop new applications of construction materials to reduce maintenance costs, increase durability, and improve performance of shore facilities.

AMPHIBIOUS AND ADVANCED BASE FACILITIES

This program provides development for the support and enhancement of construction capabilities required for the expeditious establishment, maintenance and war damage restoration of advanced bases; and provides development for high mobility Marine Corps engineer forces in both combat support and combat service support roles.

Accomplishment of program objectives will require development of technology bases in each of the following major areas:

a. Navy/Marine Corps POL Facilities. Improve the Navy/Marine Corps amphibious and advanced base bulk fuel system for delivery of POL from tankers to users ashore during an amphibious operation to meet projected needs through the mid-range.

PROGRAM WORK (CONTINUED)

b. Cargo Mobility Facilities. To meet projected needs for facilities to handle and transfer dry cargo from all type of military and commercial shipping, to and across undeveloped beaches and into shore-side and forward area distribution points.

c. Horizontal Construction. To expand and improve capabilities to plan for and provide expedient surfacings and earthwork for the construction of facilities and barriers in amphibious/advanced base operations.

d. General Facilities Construction. To develop new concepts and methodology for provision of contingency structures (facilities) that will enhance mobility and may be characterized by rapid installation and retrievability. Included would be improvement of construction capability in climatic extremes and in urban combat areas as well as enhanced combat engineer capability.

e. Services and Support. To provide concepts for optimal utility support in areas of power, water supply, and sanitation facilities for a wide range of operational levels and advanced base needs.

f. CW/CBR Defense. To provide systems and methodology for collective protection of shore based personnel from CBR threats, and for decontamination of engineering equipment.

g. RRR/ADR. To develop and/or adapt systems for identification and repair of airfield damage.

ENERGY/ENVIRONMENTAL PROTECTION SYSTEMS

The Energy/Environmental Protection product area is conducted within the following charter:

Conducts RDT&E, provides program and project leadership, planning, and management, and provides expert consulting and advisory services in fields of engineering and science related to energy, environmental protection, and occupational health and safety aspects of the planning, design, construction, maintenance, repair and operation of permanent shore facilities.

The Navy Shore Facilities Energy R&D Program, with NCEL as the lead laboratory and program manager, is structured to achieve maximum practical energy conservation and to aid in substituting, where practical or reliable alternative or renewable energy sources wherever petroleum and natural gas are now used. Three key thrusts have been selected to achieve Navy shore energy related goals:

a. Energy conservation, which involves eliminating the inefficient and wasteful use of energy and applying more energy-efficient systems.

PROGRAM WORK (CONTINUED)

b. Alternate energy sources, which involves developing a level of local self-sufficiency for Navy shore facilities through the use of alternative energy sources such as solar, wind, ocean and geothermal to prevent mission degradation caused by domestic or worldwide petroleum energy shortages.

c. Substitution of coal and alternative fuels for petroleum and natural gas through innovative approaches and emerging technolgies such as coal-water slurries and advanced combustion equipment.

The objectives to the Environmental Protection Program are to develop the technology and capability required tc minimize or eliminate the occurrence of environmental problems and to plan, design, construct and maintain Navy techniques, equipment and facilities to meet new, more demanding environmental legislation and regulations in a cost-effective manner.

Navy shore installations are required to meet federal, state and local environmental regulations. RDT&E efforts contribute to Navy compliance in the following areas:

a. Minimization/elimination of hazardous/toxic waste disposal problems by reduction, recovery and/or reuse of materials.

b. Formulation of decision criteria based upon characterization of waste streams, identification of toxic and hazardous components, and assessment of effects.

c. Formulation and evaluation of options for collection, treatment and disposal of toxic/hazardous wastes.

d. Formulation of technology and procedures to eliminate the environmental and human effects of Navy-generated hazardous/toxic wastes.

MAJOR ACCOMPLISHMENTS

OCEAN FACILITIES

a. **Multi Function Tool System (MFTS)**: All components of the seawater powered MFTS were approved for Navy use by NAVSEA-00C on April 27th. Training for the use of these tools for the Underwater Construction Teams has been scheduled. A technology transfer demonstration of the MFTS was conducted at Eastport International, Maryland, by NCEL personnel. Approximately 60 people from NAVFAC, NAVSEA and other government and private organizations attended the demonstration.

b. **Waterside Security Demonstration Model**: The 200-foot-long floating barrier system was successfully installed at the Naval Submarine Base, Bangor, WA. Two 40-foot sections, one a cylinder pontoon and the other made of interconnected NAVFAC pontoons, were installed last year. The three center outrigger-type floating barrier sections of welded steel construction were successfully installed in June 1987. The main floats are 4 feet in diameter and the outrigger is 2-1/2 feet in diameter. The center outrigger section is a model of a barrier gate. After installation the barrier gate was readily opened and closed, providing a 45-foot wide passage, by three different types of boats.

c. **Underwater Construction Systems**: Fabrication of the UCT Buried Pipe and Chain Locator has been completed. Laboratory, ocean, and user (UCT) testing is scheduled for the third and fourth quarters. Tests of the UCT Modular Construction Platform demonstrated that a 60 x 24-foot platform can be assembled on the beach and launched within 48 hours by a team of UCTs using chain-falls and a 15-ton winch. Design and fabrication of the engineering development model diver lift system is on-going under contract to Eastport International, Inc. The MFTS power sources, manuals, and training aids were delivered, and training was given to UCT-ONE. The TEMPs for the Arctic Advanced Development System were completed and forwarded to the sponsor. Components of the Remote Site Power Source that satisfy the advanced development model design criteria have been selected.

d. **Synthetic Lines for Offshore Tactical Aircrew Combat Training Systems (TACT)**: Low-cycle fatigue testing of two types of synthetic lines were completed. Two samples of 2.5-inch-diameter polyester Superline (breaking strength of 260,000 lb) and two samples of 1.5-inch-diameter Kevlar Parafil (breaking strength of 207,800 lb) survived 2 million cycles of tension between 8% and 25% of their break strength. These data are to establish a specification for a Qualified Products List for the deepwater TACTS mooring lines.

e. **Offshore Tactical Aircrew Combat Training Systems**: Over 750 megabytes of raw data have been collected from the Motion Measurement Experiment (semisubmersible moored in 2910 feet of water). In early March several significant storm data sets were

MAJOR ACCOMPLISHMENTS (CONTINUED)

recorded and, therefore, the data collection aspect of the experiment is a success. The focus now turns to analyzing the large volume of raw data.

SHORE FACILITIES

a. **Pier Planning Model**: The model is usable with GEMS hardware and is a 3-D automated graphic system with ship database files and computational routines that generate berthing options, determine pier geometry, optimize pier utility location, analyze environmental forces due to wind and currents, and predict tension and compression forces on mooring hardware.

b. **Seismic Mitigation**: Exploratory development of the Princeton Effective Stress Soil Model (PESM) was completed. The soil model gives a new capability for evaluating the potential for occurrence of soil liquefaction around major structures (drydocks, wharves, fuel farms, etc.). Navy facilities are predominately sited at the waterfront on reclaimed land which is especially vulnerable to liquefaction. The PESM is now available as an analytic tool for research use in development of mitigation measures to minimize structural damage, loss of life, and mission impairment which would be caused by a major seismic event. The Navy has $30 billion of facilities at risk in earthquake prone areas.

c. **Low VOC Epoxy**: Interim criteria were developed for waterborne and high solids-based epoxy coating systems. These coating systems have significantly reduced volatile organic content with respect to systems specified by previous Navy criteria. These low emission epoxy systems enable Navy painting operations to be in compliance with strict environmental statutes which will be in effect by December 1987, and to thereby avoid monetary penalties for disruption of facilities painting operations. The new formulations also provide equal or superior performance to that obtained with previous solvent-based systems. This effort is being transitioned to PE63721N: Project Y-0817 for development of final criteria and filed validation.

d. **Expert system**: A feasibility module was completed for an expert system (ES) for painting/coating of Naval facilities. The expert system was demonstrated to potential NAVFAC users and received favorable comment. This paints/coating ES has transitioned (FY88) to PE63725N, Project Y-0995, for final development and validation. The expert system will ensure the availability of expert painting advice at Engineering Field Divisions and is expected to afford a 15% annual savings in the $150 million per year spent by the Navy in the maintenance painting of shore facilities.

e. **Ground Probing Radar**: The development of signal processing/image reconstruction software was successfully completed for a Ground Probing Radar (GPR). The GPR system is expected to afford a $17 million per year reduction in construction change orders which are incurred from encountering unforeseen

MAJOR ACCOMPLISHMENTS (CONTINUED)

underground obstacles. In the feasibility demonstration test, actual GPR data were enhanced to clearly show the presence of buried metallic and plastic pipes which were otherwise not discernible in the raw data.

f. **Missile Test Cells**: NCEL Technical Memorandum M-51-87-06: ''*Development Plan and Assessment of* Alternative Preliminary Designs for NAVFAC IV Missile Test Cell for WALLEYE and NAVFAC Type V Missile Test Cell for SEA LANCE, TOMAHAWK, and STANDARD (R&D) was forwarded via NCEL ltr Ser L51/0739 of 8 May 1987. This document contains an assessment of two alternative design concepts and presents a milestone schedule which included an explosive validation test. A report is being prepared to address unresolved technical issues based upon a literature search and response from the AE designers of the concepts. This report will be the primary document for development of a Basis of Design (BOD) for Type IV Missile Test Cells.

AMPHIBIOUS/ADVANCED BASE FACILITIES

a. **Marine Corps AAV7A1 Amphibious Assault Vehicle Mine Plow**: Mine plows for mechanically removing land mines for a path are commonly hosted by battle tanks having nominally twice the weight and power of the AAV7A1. The feasibility of using the AAV7A1 to push a specially designed mine plow through most of the accessible soil types was demonstrated. This work has transitioned to Advanced Development at the Naval Coastal Systems Center, which supported the Exploratory Development work by NCEL.

b. **Air Base Survivability**: A Marine Corps Mission Area Analysis (MAA) for Air Base Survivability was completed. The analysis emphasized the need for optimum preservation and employment of aircraft, equipment and facilities from forward bases in support of the Maritime Strategy. The MAA examined the threat to air bases, assessed the current capability to cope with an attack, and identified several deficiencies.

c. **Helicopter External Lift Certification**: The CH-53E can lift equipment that could not previously be transported by helicopter and that, as a consequence, had not been certified for helicopter external lift. More than 250 items that need testing and certification have been identified. To data, 53 have been tested under static loading at NCEL and then flight tested at nearby Marine Corps Air Stations. Several of these have required design changes, strengthening and/or relocation of lift points to qualify them for lift certification.

d. **Marine Corps Maritime Prepositioned Expeditionary Aircraft Maintenance Shelter (MPEAMS)**: Fabrication of the first of 15 MPEAMS has been completed and delivery to NCEL is expected by 10 July 1987. NCEL will perform first article testing of this 145 x 70-foot commercial shelter. A test plan has been completed and testing will start on 20 July 1987. Objectives of the test are to verify the adequacy of

MAJOR ACCOMPLISHMENTS (CONTINUED)

delivered components and manuals, validate all erection/strike and operating procedures, and check for compliance with Marine Corps requirements. In order to incorporate end-user comments and recommendations into the final test report, Marine Corps personnel will be assisting in the testing. The Marine Corps plans to place these shelters aboard Maritime Prepositioning Ships (MPS) 1, 2, and 3.

e. **Advanced Cargo Transfer Facility (ACTF)**: A trade-off study was conducted which resulted in the selection of a candidate dolphin system design. The dolphin consists of a gravity base, a movable fender, a skirt assembly, and a foldable frame. A more detailed design will be accomplished under contract.

f. **Survivability of Construction Equipment**: In order to provide improved support to their mobile forces, the Marine Corps is investigating armoring some of its construction equipment. NCEL fitted an Israeli Military Industries armor protection kit to a D7F dozer. The kit adds approximately 11,000 pounds to the 55,000-pound dozer and is designed to protect both the operator and the vehicle from 14.5mm armor piercing rounds and fragments from 155mm projectiles. The productivity of the modified dozer will be evaluated in FY88.

g. **Long Length Fuel Hose Tests**: A final report was submitted to the Marine Corps outlining results of field tests using 3,000-foot hose lengths vice 600-foot lengths in the Marine Corps POL system. Manpower savings of five man-hours per three-mile hoseline installation were achieved, and a 500 percent increase in MTBF was achieved. Other benefits were a weight savings of 6,000 pounds in the MAF hose requirements, a 20 percent reduction in the number of hosereels required, and a reduction of 1,316 square feet (13,000 cubic feet) in shipping space required for MAF transport of hoseline.

h. **Water Well Drill Rig**: The prototype water well drill rig successfully completed both developmental test and operational test series with both air and mud systems. The rig's reliability and depth capacity of up to 1,500 feet was demonstrated in tests at several field sites including NCEL, NAS Point Mugu, and Camp Hunter-Liggett. Efforts are continuing to develop the specification and procurement packages for initial procurements through the Civil Engineering Support Office.

i. **ISO Container Connectors**: Test and evaluation of nondevelopmental horizontal intermodal container connectors was completed. All five alternative connectors appear to meet the strength requirement for coupling Marine Corps containers and shelters into arrays up to 20 feet long. The five connectors were rank ordered in regard to five operational parameters.

MAJOR ACCOMPLISHMENTS (CONTINUED)

ENERGY AND ENVIRONMENT

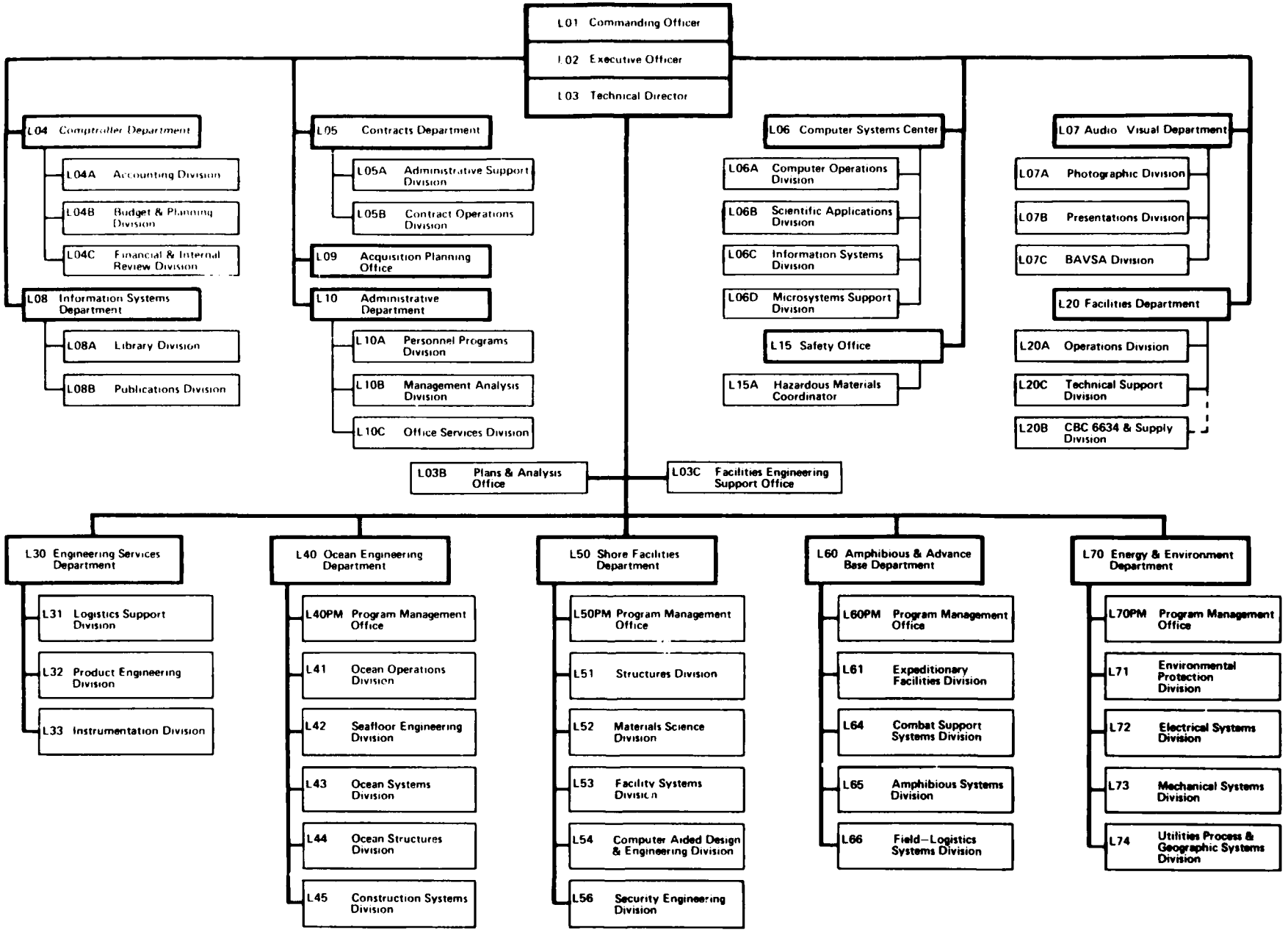
a. **Low Temperature Solar Technologies**: The project is tasked with investigating low-cost Solar Domestic Hot Water Systems. A unique thin-film collector made of plastic materials has been under test and evaluation at NAS Fallon, NV. This design uses a thin-film absorber that maintains good thermal efficiency, yet is lightweight, easily replaced, and significantly less in cost than metal absorbers. The operational results are discussed in a report issued this quarter, TM-73-87-06, ''Operational Test Report of a Thin-Film Solar Collector Domestic Hot Water System.''

b. **Steam Purification**: A laboratory apparatus was configured and tested for the generation of free CO_2 steam. A liquid film was developed in a velocity controlled environment. The film was separated from the CO_2 rich steam. The film pH was between 6 and 7 with a conductivity below 2 ϕmho/cm. These levels were experienced for film flow/steam flow varying from 0.1 to 0.8. This is a significant finding as it indicates the creation of a pure fluid over a surprisingly wide range of conditions. Regeneration of the liquid film to steam yielded similarly pure steam. This total system concept is termed the Inverse Flash Steam Purifier (IFSP) and a patent is pending. Preliminary performance of the IFSP reveals that an impure feed steam of near 100 ppm can be reduced near two orders of magnitude. Solubility constants at these high total pressures and temperatures are now being determined.

c. **Inland Oil Skimmer**: The Navy has a new inland oil skimmer as of FY88. The Crowley-Alden A-4 skimmer is designed for harbor and river use in waves up to 3 feet tall. Manpower requirements over former skimmers can be decreased by 50 percent with an increase in performance. A user data package on the skimmer has been prepared to assist activities in implementing this equipment.

d. **Hazardous Waste Minimization IDR**: This Initiation Decision Report surveyed 225 of the Navy's largest hazardous waste generating operations and identified specific technologies for the reduction of hazardous waste from each process. Some recommended technologies can be readily implemented by Naval activities and others will need continuing RDT&E before they can provide solutions to the Navy's hazardous waste problems.

e. **NACIP Program IDR**: The Remedial Measures Initiation Decision Report for the Navy Assessment and Control of Installation Pollutants Program has been completed and distributed. This document evaluates past disposal practices of the Navy based on Initial Assessment Study data and identifies the major problem areas based on contaminant - media pairing. The report assesses available technologies and recommends specific technologies for further RDT&E.



Date	Approved	Title of Parent Organization	Title of Activity	Chart No.
9/18/87	CAPTAIN, CEC, USN COMMANDING OFFICER	NAVAL FACILITIES ENGINEERING COMMAND	NAVAL CIVIL ENGINEERING LABORATORY	1 of 1

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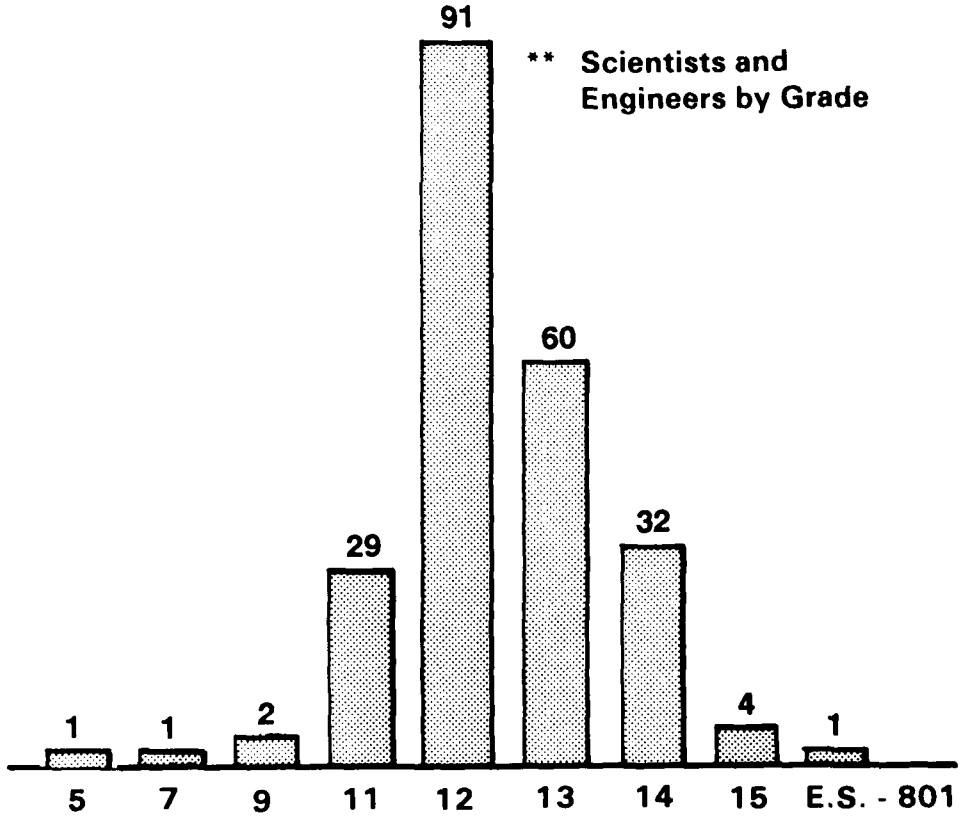
30 September 1987

PERSONNEL

* Temporary, Part-Time, Intermittent (Summer Employees Excluded)

** Eight Entry Level Engineers (GS-5/7/9) Employed at NCEL Under the NAVFAC Professional Development Center Program Not Included in Personnel Data.



** Scientists and Engineers by Grade

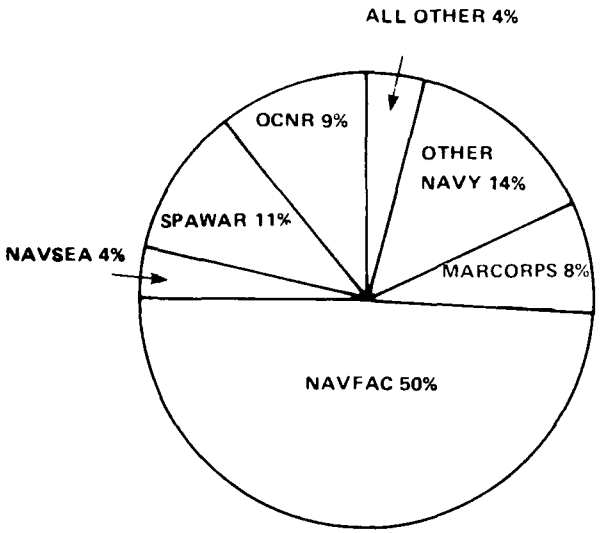
On Board		406
Total Military		18
Officer	6	
Enlisted	12	
Total Civilian		406
FTP		406
TPTI*		0
FTP Ungraded		16
FTP Graded		389
Scientists & Engineers	221	
Technicians	32	
Administrative	89	
Other	64	
Civilian Ceiling		406
Military Allowance		18
Officer	6	
Enlisted	12	

30 September 1987

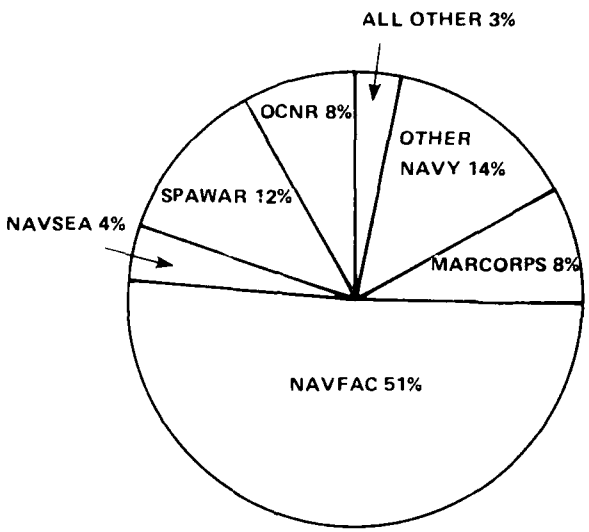
Source of Funds

NOR

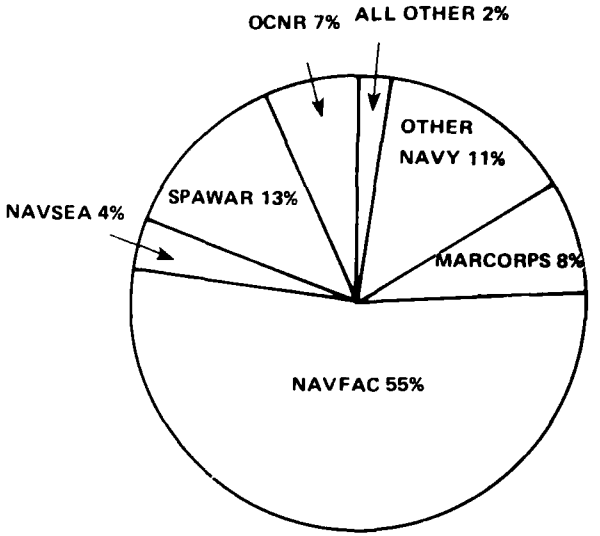
FY 1987 Actual



FY 1988 Estimated



FY 1989 Estimated



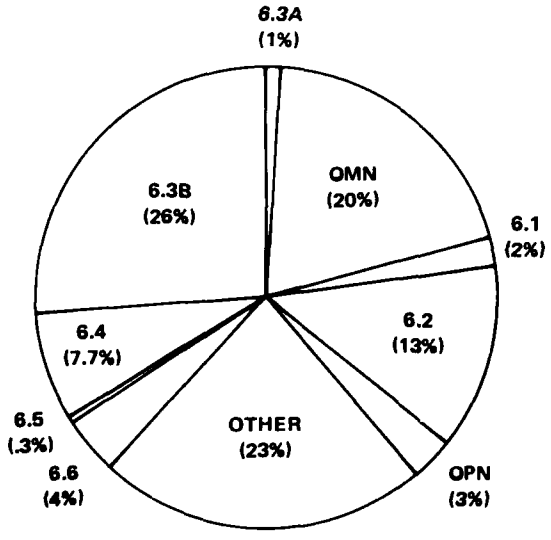
Sponsor	FY87 Act.	FY88 Est.	FY89 Est.
OCNR OFFICE OF THE – Chief of Naval Research	$ 5.0	$ 4.6	$ 4.0
SPAWARSYSCOM -- Space and Naval Warfare Systems Command	6.1	6.9	7.5
NAVSEA – Naval Sea Systems Command	2.1	2.2	2.3
NAVFAC – Naval Facilities Engineering Command	28.4	29.9	31.9
MARINE CORPS	4.8	4.9	5.0
OTHER NAVY	8.0	8.2	8.4
ALL OTHER	2.4	1.9	1.3
TOTAL	$ 56.8	58.6	60.4

30 September 1987

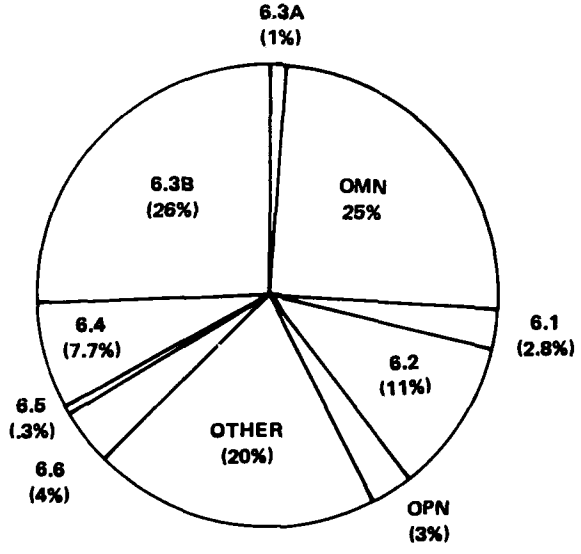
Funding by Appropriation

NOR

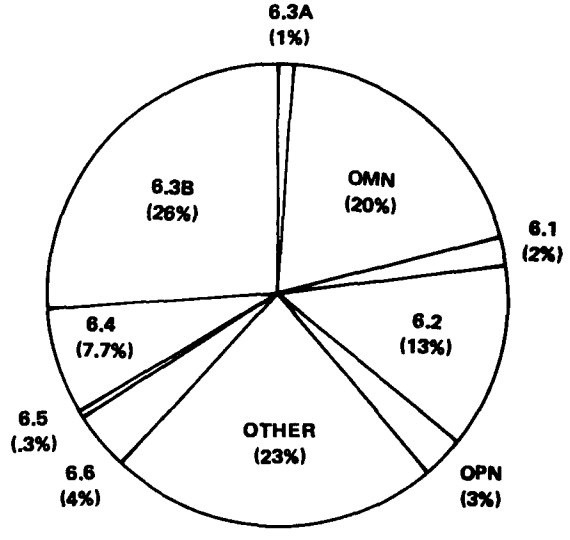
FY 1987
Actual



FY 1988
Estimated



FY 1989
Estimated



30 September 1987

FUNDS BY CATEGORY AND TYPE
(NOR)* $M

	FY 1987			FY 1988			FY 1989		
	$M Act.	% of RDT&E	% of Total	$M Est.	% of RDT&E	% of Total	$M Est.	% of RDT&E	% of Total
RDT&E, N (Category)									
6.1 Research	1.4	4.0	2.0	1.5	4.0	2.0	1.6	4.0	2.0
6.2 Exploratory Development	8.4	24.0	13.0	7.7	21.0	11.0	7.0	18.0	13.0
6.3A Advanced Technology Development	0.9	3.0	1.0	0.1	1.0	1.0	1.1	3.0	1.0
Subtotal	10.7	31.0	16.0	9.3	26.0	14.0	9.7	25.0	16.0
6.3B Advanced Development	17.2	47.0	26.0	18.6	51.0	26.0	21.1	54.0	26.0
6.4 Engineering Development	4.5	13.0	7.0	5.3	14.0	7.7	4.7	12.0	7.7
6.5 Management and Support	0.3	1.0	3.0	0.3	1.0	0.3	0.3	1.0	0.3
6.6 Operational Systems Development	2.3	6.0	4.0	2.4	6.0	4.0	2.5	6.0	4.0
RDT&E, N Subtotal	34.9	67.0	40.0	26.6	72.0	38.0	38.3	73.0	38.0
Other RDT&E	0.7	2.0	--	0.8	2.0	--	0.9	2.0	--
Total RDT&E	35.6	100.0	56.0	36.8	100.0	52.0	39.2	100.0	54.0
Other Appropriation									
(OPN) Other Procurement, Navy	2.0		3.0	7.1		3.0	7.3		3.0
(O&MN) Operation & Maintenance, Navy	13.4		20.0	20.7		25.0	23.8		20.0
Other	15.3		21.0	4.0		20.0	4.3		23.0
Appropriation Subtotal	30.7		44.0	31.8		48.0	35.1		46.0
Totals	66.4		100.0	68.6		100.0	74.3		100.0

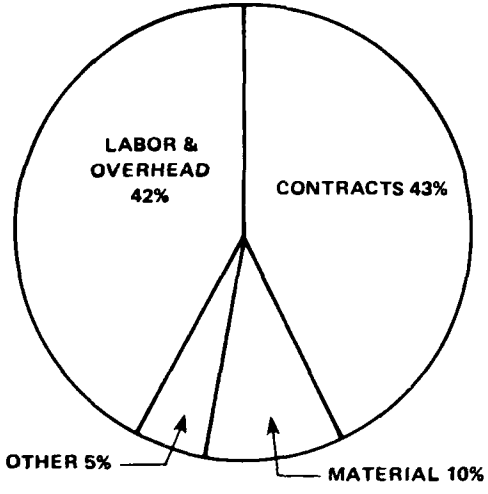
*New Orders Received (NOR)

30 September 1987

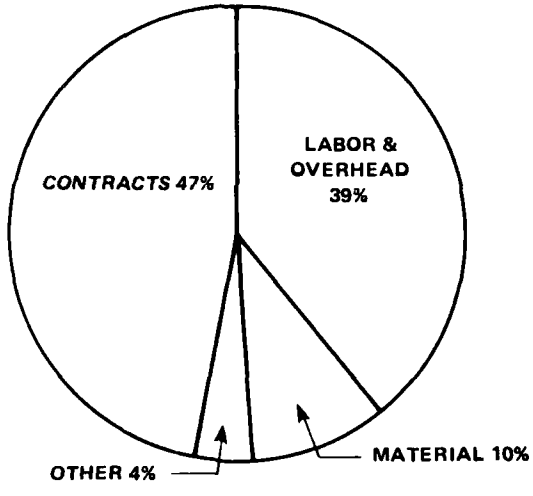
Distribution of Funds

TOA

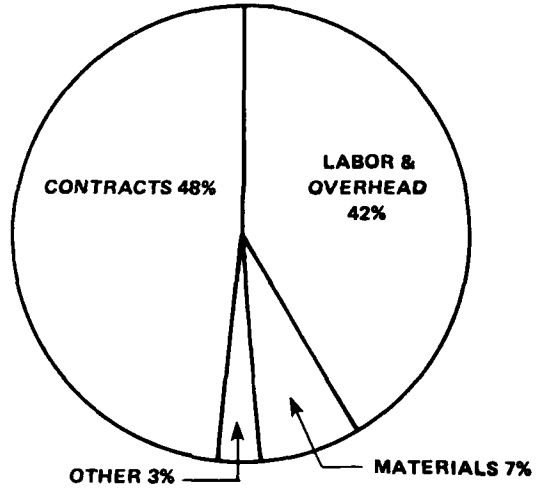
FY 1987
Actual



FY 1988
Estimated



FY 1989
Estimated



Distribution ($M)	FY87 Act.	FY88 Est.	FY89 Est.
Labor & Overhead	$ 17.5	$ 16.8	$ 18.4
Material	4.2	4.3	3.2
Contracts	18.0	20.2	21.4
Other	2.1	1.8	1.4
TOTAL	41.8	43.1	44.4

30 September 1987

FUNCTIONS AND RESPONSIBILITIES

As Assigned by NAVFAC Instruction 5450.92A of 13 May 1983

Functions: The Naval Civil Engineering Laboratory conducts and maintains the primary inservice engineering support capability for the following Navy and Marine Corps products:

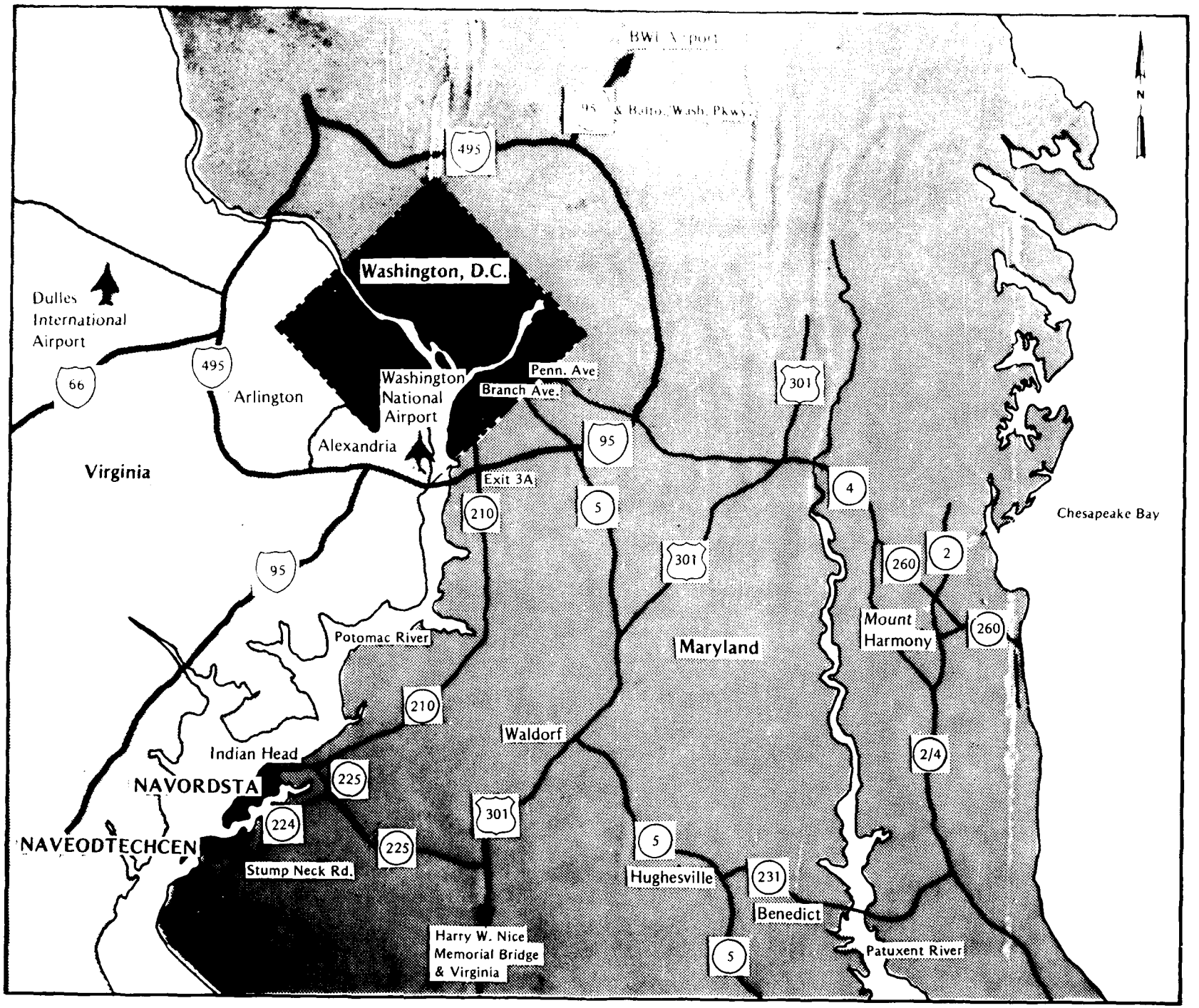
CNM PRODUCT AREA	NCEL PRODUCT LINE
	80 - General Mission Support
82. Offshore Facilities	a. Cable Systems
	b. Soil Mechanics
	c. Foundations and Anchorages
	d. Power Transmission
	e. Construction Systems
	f. Ocean Structures
Contingency/Advanced Base Facilities	a. POL Facilities
	b. Cargo Mobility Facilities
	c. Horizontal Construction
	d. Vertical Construction
	e. Utilities
	f. Containerized Facilities
Permanent Shore Facilities	a. Facilities Planning and Design
	b. Construction, Inspection and Maintenance
	c. Fire Protection
	d. Structures
	e. Physical Security
	f. Utilities
	g. Soils, Foundations and Pavements
	h. Construction Materials
	i. Port Systems
	j. Airfield Systems
	k. Special Facilities
	l. Accidental Explosive Effects on Facilities

30 September 1987

	Energy Systems for Shore Facilities	a. Thermal Conservation b. Controls and Electrical Construction c. Fuel Flexibility d. Renewable Sources e. Systems Integration
	Environmental Protection for Shore Activities	a. Water Pollution Control b. Air Pollution Control c. Solid Waste Management d. Land Use and Ecosystems e. Monitoring Measurement and Control
	Diving/Salvage and Ocean Engineering	a. Inspection/Maintenance of Ocean Facilities b. Construction Tools for UCT's
95.	Laboratory Mission and Functions	a. Basic Research and Independent Exploratory Development Activities

NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY brief

30 SEPTEMBER 1987



30 SEPTEMBER 1987

MISSION

PROVIDE EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY AND LOGISTICS MANAGEMENT FOR THE JOINT SERVICES; AND DEVELOP WAR ESSENTIAL ELEMENTS OF INTELLIGENCE, EQUIPMENT AND PROCEDURES TO COUNTER MUNITIONS BOTH U. S. AND FOREIGN, AS REQUIRED TO SUPPORT DEPARTMENT OF DEFENSE COMPONENTS AND THE PEACE TIME SECURITY NEEDS OF OTHER AGENCIES; AS ASSIGNED BY COMMANDER, NAVAL SEA SYSTEMS COMMAND.

HISTORY

NAVEODTECHCEN traces its origin back to World War II, when the Navy recognized the need for countering the more advanced and complex weapons systems being deployed by the axis nations. To satisfy this new requirement, the Navy established a Naval Mine Disposal School at the Naval Gun Factory in May of 1941. Later that year, a Naval Bomb Disposal School was also established.

Graduates from these Schools proved the new technology to be highly effective in the neutralization and disposal of these weapons, both during and after the war. EOD had now established itself as a viable program within the Navy, and in 1945, the Naval Mine and Bomb Disposal Schools were combined into the Naval Ordnance Disposal Unit. In 1946, this new Unit was moved to the Naval Powder Factory, Indian Head, Maryland.

In 1951, the Navy was assigned Joint-service EOD responsibilities for basic training and research and development. Two years later, the research and development tasks were established as a separate organization, and redesignated the Naval Explosive Ordnance Disposal Technical Center. The new Center was located at the Stump Neck Annex. The training function was renamed the Naval Explosive Ordnance Disposal School, and remained at the Naval Powder Factory.

After the Center's inception, the Navy tasked the Center with significant additional mission responsibilities. In 1955, to accomplish these additional tasks, the Center's technical staff was expanded to include civilian engineers and technicians. In 1962 the Center was redesignated the Naval Explosive Ordnance Disposal Facility (NAVEODFAC), and placed under the direction of a Commanding Officer.

NAVEODFAC's continued military and technical contributions to the Joint-service EOD program were further recognized in 1971 when the Facility was designated as an Echelon 4 activity under the Naval Ordnance Systems Command. Later the same year, DOD Directive 5160.62 assigned the Secretary of the Navy as Single Manager for Military Explosive Ordnance Disposal Technology and Training. Subsequently, NAVEODFAC was tasked to provide the EOD research and development in carrying out the Secretary of the Navy's responsibility for meeting Joint-service EOD technology requirements. In late 1980, NAVEODFAC was redesignated the Naval Explosive Ordnance Disposal Technology Center.

INTRODUCTION

AREAS OF EFFORT

The Naval Explosive Ordnance Disposal Technology Center (NAVEODTECHCEN) is responsible for the research and development of specialized equipment, tools, techniques, and procedures required to support operational explosive ordnance disposal (EOD) units in the location, neutralization, and disposal of surface and underwater explosive ordnance.

The Joint-service program encompasses all current and obsolete domestic and foreign explosive ordnance, including improvised explosive and nuclear devices that may be employed by dissident and terrorist groups. NAVEODTECHCEN also provides significant support to activities concerned with the demilitarization of chemical weapons, and the reclamation of ordnance-contaminated land and water aeas. Special support is provided to the Federal Bureau of Investigation, the Secret Service, civilian law enforcement agencies, and other government departments. Current arrangements allow for information exchange with 13 allied nations.

FUNDING AND PERSONNEL

As of 30 September 1987, NAVEODTECHCEN employed 225 civilians and 58 military personnel. Total funding for FY 87 was $86.3 million; approximately 28 percent of this funding was received from the Naval Sea Systems Command (NAVSEASYSCOM).

FACILITIES

NAVEODTECHCEN is located on the Stump Neck Annex of the Naval Ordnance Station, Indian Head, Maryland, which provides support through a Host-Tenant Agreement. NAVEODTECHCEN furnishes administrative support to the co-located Army, Air Force, Navy, and Marine Corps Service Detachments and the Joint-Service Military Technical Acceptance Board established by the Department of Defense to approve EOD equipment for Service use. The NAVEODTECHCEN also operates a special explosive test range at White Sands, New Mexico.

Property Date:	
Land Owned/Leased:	1,087 acres
Buildings:	
RDT&E:	63,725 square feet
Administrative:	19,375 square feet
Technical Information:	9,000 square feet
Equipment Management:	22,705 square feet
Operations Support:	1,250 square feet
Munitions Evaluation:	27,350 square feet
Supply:	21,379 square feet

Acquisition Costs:	
Class I:	25,200
Class II:	4.7 million
Replacement Cost for Class II:	25.0 million
Real Property	
Classes I & II:	10.5 million
Equipment	
Class III:	4.4 million
Class IV:	.8 million

SPECIAL FACILITIES

UNDERWATER TEST FACILITY

A hyperbaric test chamber complex enables the simulation of water depths to 300 feet with a controlled temperature environment from 38°F to 130°F for equipment evaluation and diver life support system development. The facility also includes a decompression chamber in support of diver safety.

HYPERVELOCITY TEST FACILITY

A high-speed camera capable of exposing over one million frames per second coupled with a flash X-ray and multiple transducer system provides the capability to collect data on explosive device hypervelocity phenomena.

MAGNETOMETRY FACILITY

A test facility having a stable-background magnetic field is maintained for low-level static and dynamic magnetic anomaly testing required to certify special tools used on magnetically sensitive devices.

TOOL DESIGN AND MODEL SHOP FACILITIES

The Tool Design and Model Shop is a unique combination of skilled tradesmen and equipment. The purpose of which is to fabricate prototype tools and training aids in support of the EOD mission.

TECHNICAL LIBRARY

Provides immediate research access to over 275,000 ordnance-related publications from the pre-Revolutionary War era to the present, and data-base access to a wide range of subject matter worldwide.

MUNITION DISASSEMBLY FACILITY

Remotely operated disassembly equipment housed in an explosive-proof building provides an essential munitions evaluation capability. Physical, chemical, and functional data are documented by photography, X-ray, and precise measurement equipment.

RADIOGRAPHY INSPECTION LABORATORY

Radiography, X-ray, fluoroscopic, and ultrasonic equipment enables the internal viewing and film recording of munitions weighing up to 3,000 pounds.

CHEMICAL LABORATORY

The chemical laboratory supports ongoing programs in explosive analysis, explosive detection, polymer applications, gas separation technology, and pyrotechnic development. A quick-response capability is provided to the EOD community in those areas which require nonroutine analysis, examination, documentation, testing, or test hardware development.

EXPLOSIVE TEST RANGES

One 60-pound range on base, and a 3,000-pound range at White Sands, New Mexico provide facilities to validate and verify techniques and procedures developed in support of Service requirements.

MAGAZINE COMPLEX

The Munitions Evaluation Department maintains an Explosive Storage Complex for the storage of demolition materials and project related munition items.

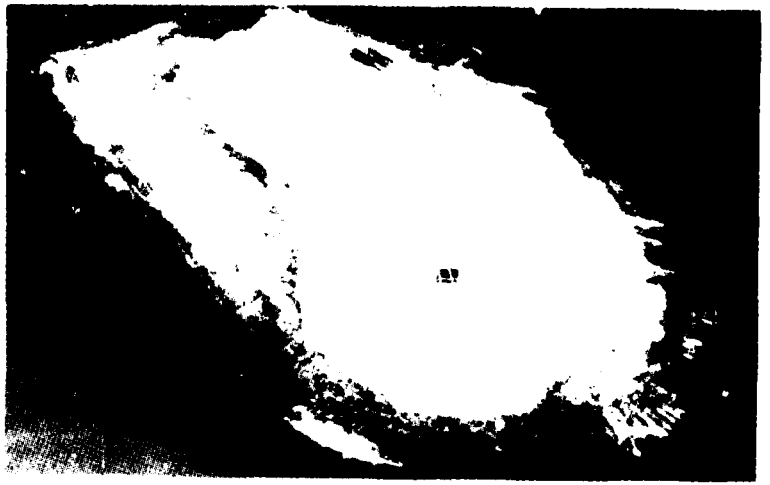
PUBLICATION PREPARATION/DISTRIBUTION

Provides the capability to prepare, produce, and distribute field-use publications to 160 locations worldwide, and maintain over 1,700 publications currently in use by the Joint Services, both in hard copy and microfiche.

PHOTOGRAPHIC LABORATORY

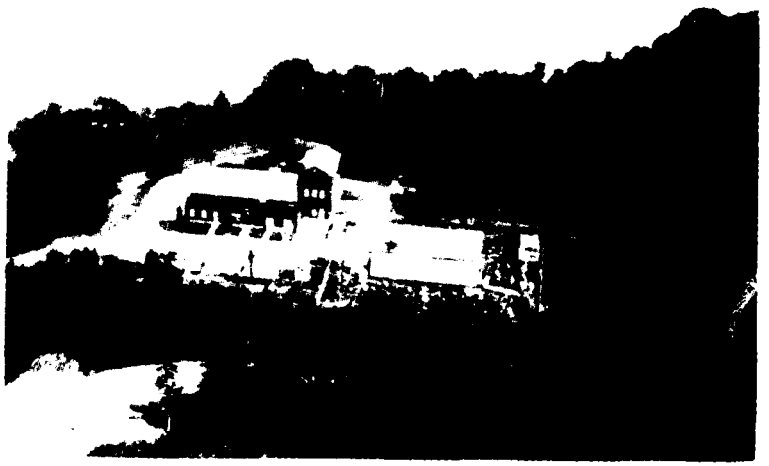
Military photographers provide a complete range of still and motion picture service in addition to a modern film processing laboratory.

HEADQUARTERS, TECHNICAL OPERATIONS, & RESEARCH AND DEVELOPMENT BUILDINGS



HYPERVELOCITY RANGE

UNDERWATER OPERATIONS BUILDING & HYPERBARIC COMPLEX



PHOTOGRAPHIC LAB & RADIOLOGICAL BUILDING

PROGRAM WORK

NAVEODTECHCEN is responsible for the following general program areas:

DETECTION/LOCATION

Methods and equipment used to detect and locate ferrous, nonferrous, and nonmetallic objects.

ACCESS

Ability to gain case entry of explosive ordnance to expose fillers (explosives, chemical agents, etc.) for subsequent neutralization or disposal.

IDENTIFICATION

Procedures to identify external features, internal component configuration, and filler material.

RENDER SAFE

Procedures, tools, and equipment to neutralize, disrupt, or deactivate explosive ordnance.

RECOVERY

Procedures and equipment to safely retrieve and/or remove explosive ordnance and submunitions from the environments in which they are found.

DISPOSAL

Techniques and procedures for elimination of explosive hazards and the decontamination and/or neutralization of chemical agents, fuels, and nuclear materials.

SUPPORT

Special tools and equipment required to assist in the performance of other mission areas that provide a margin of safety to the EOD field technician.

RANGE CLEARANCE

Procedures and equipment for clearance and reclamation of ordnance-contaminated land and water areas.

CHEMICAL

In concert with Chemical Systems Laboratory located at Edgewood Arsenal, Maryland, develops requirements for chemical, biological, and radiological protection and as necessary provides for the development of specialized related EOD support equipment.

IMPROVISED NUCLEAR DEVICE TECHNOLOGY

Procedures, equipment, and technology to provide EOD countermeasures for improvised nuclear devices. Efforts are in support of an inter-agency national capability.

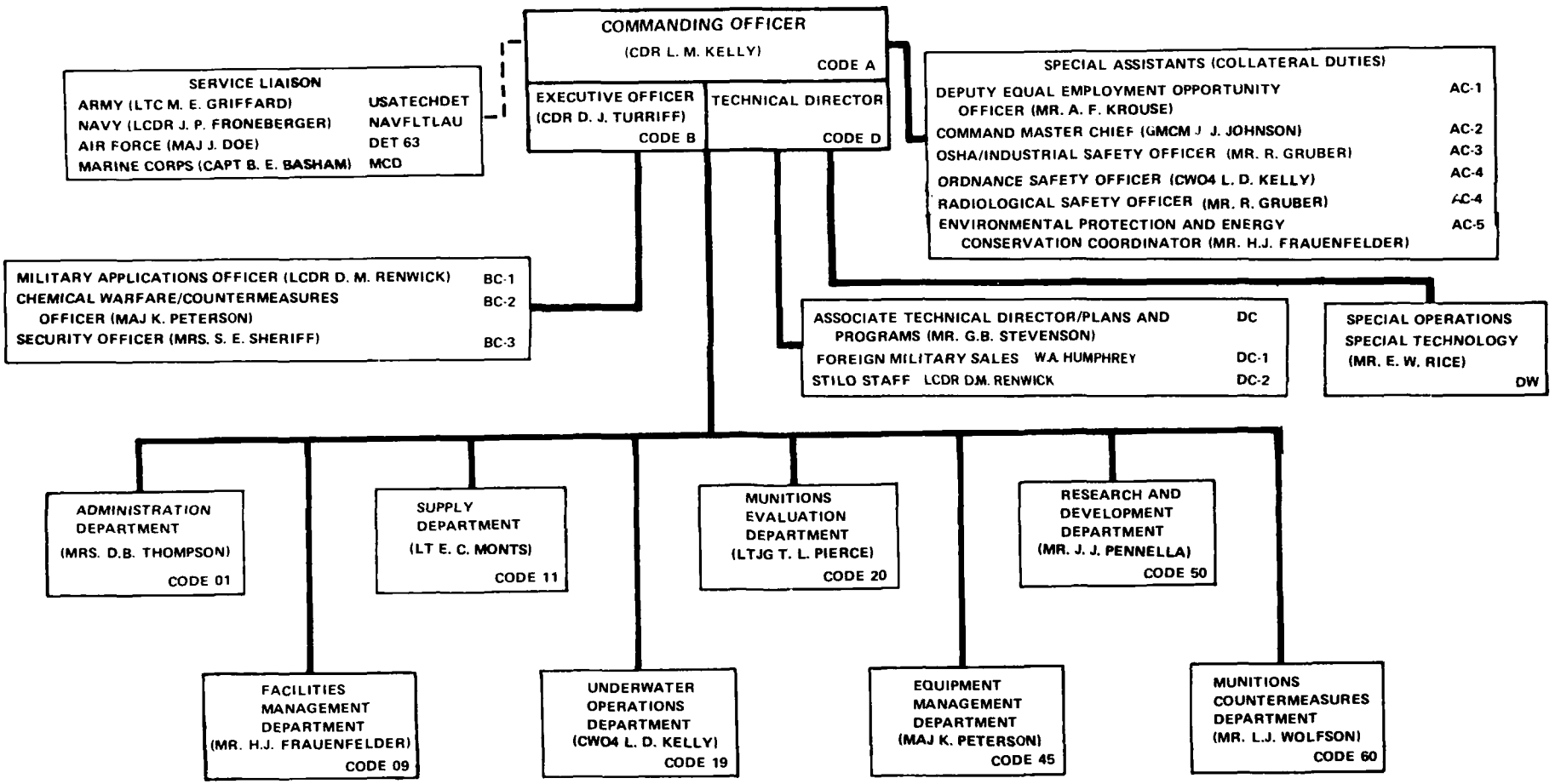
SPECIAL OPERATIONS/SPECIAL TECHNOLOGY

Provide technical management of the DOD Program supporting the Joint Service Special Operational Forces.

MAJOR ACCOMPLISHMENTS

- A significantly improved navigation system was tested and approved for production
- Technical support was provided to the operational forces during deployments to the Persian Gulf.
- Development of a diver-operated handheld ordnance locator was completed.
- MK 16 Underwater Breathing Apparatus was released to the Operational and Training Commands.
- A new technology is being conducted to develop a state-of-the-art capability to clear contaminated range areas. The program is in support of an Army Corps of Engineers program to clear ordnance, debris, and toxic materials from formerly used DOD lands that have been transferred to other government agencies or the private sector.
- A low cost fiber optic magnetic sensor has been built and demonstrated.
- Intergrated exercises with operational Army EOD detachments have been conducted to demonstrate effectiveness of new technology concepts.
- Fabrication and demonstration of an improved system for enhanced visibility in turbid water was completed.
- Technical support was provided DOD and law enforcement officials to enhance national countermeasures against terrorist devices.
- Specialized underwater search capabilities using a remote vehicle was provided to the fleet operational forces.

NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CENTER



30 SEPTEMBER 1987

NAVEODTECHCEN

PERSONNEL DATA

ONBOARD

MILITARY

OFFICER	9
ENLISTED	49
TOTAL	58

CIVILIAN

FULL TIME PERMANENT	
GRADED	202
UNGRADED	13
TEMP./PART TIME/INTERMITTENT	10
TOTAL	225

GRADED

ADMINISTRATIVE 3000-4000	62
TECHNICIANS 5000	45
SCIENTISTS AND ENGINEERS 2000	60
OTHERS 6000-7000	35
GRADED TOTAL	202

CIVILIAN CEILING	250
MILITARY ALLOWANCE	71
OFFICER	9
ENLISTED	62

30 SEPTEMBER 1987

NAVEODTECHCEN

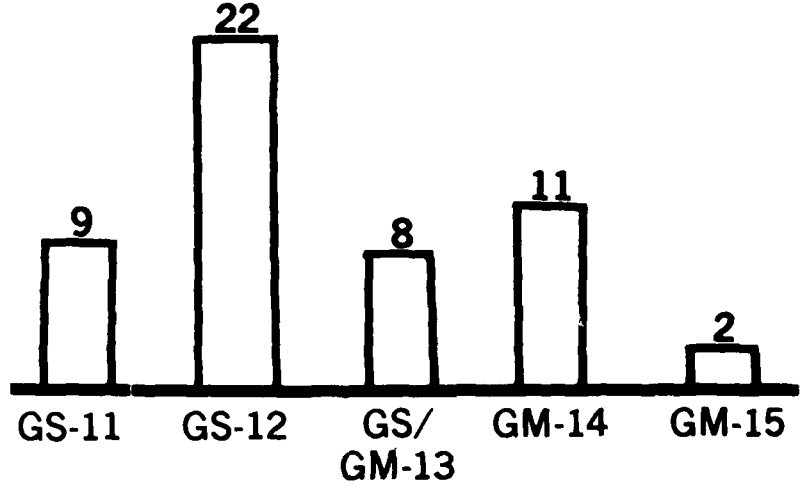
PERSONNEL DATA

SCIENTISTS AND ENGINEERS

BY FIELD

GENERAL ENGINEERS (GS-801)	12
ELECTRONIC ENGINEERS (GS-855)	22
MECHANICAL ENGINEERS (GS-830)	15
CHEMICAL ENGINEERS (GS-893)	9
CHEMISTS (GS-1320)	0
PHYSICISTS (GS-1310)	1
OTHER SCIENTISTS (GS-1301)	1
	60

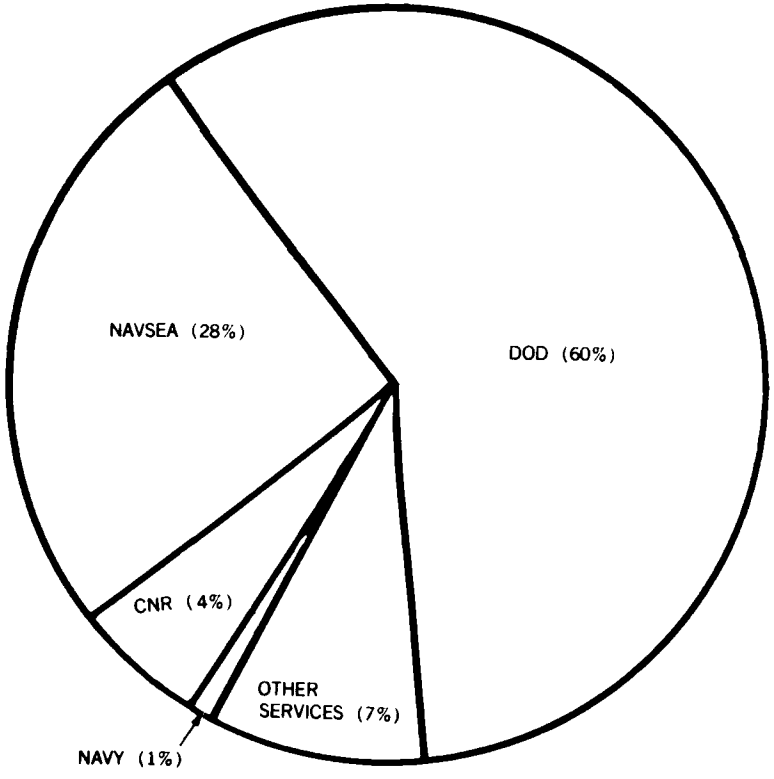
BY GRADE



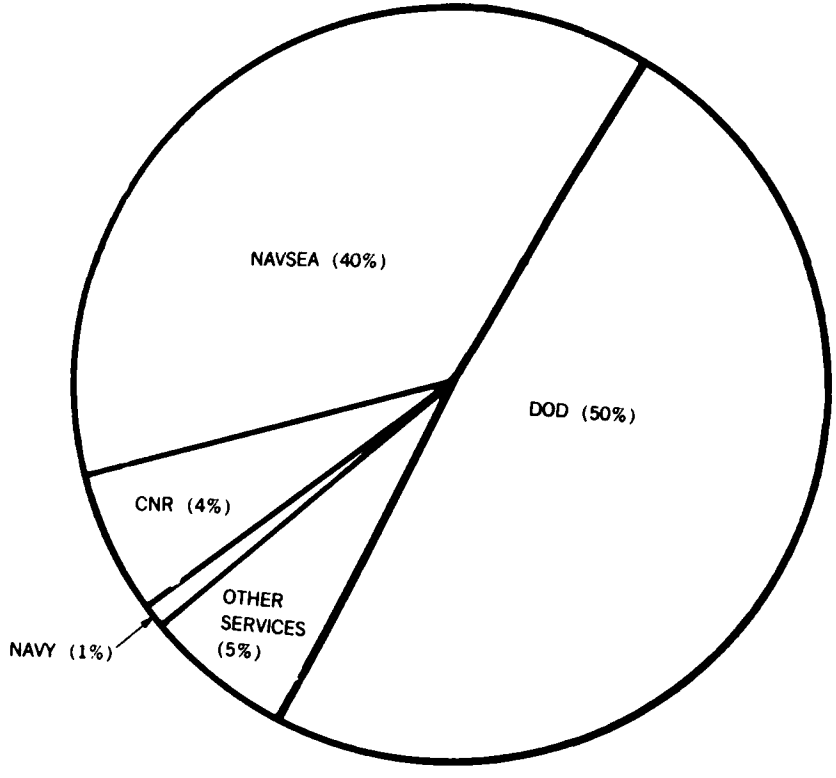
30 SEPTEMBER 1987

FUNDING BY SPONSOR

FY 87

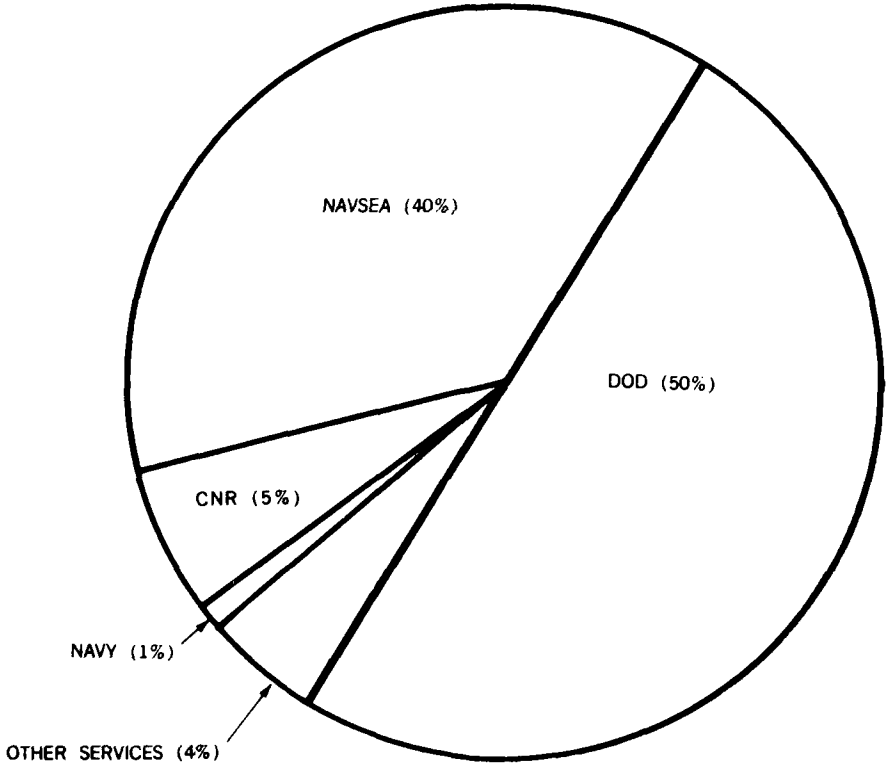


FY 88



FUNDING BY SPONSOR
(Continued)

FY 89



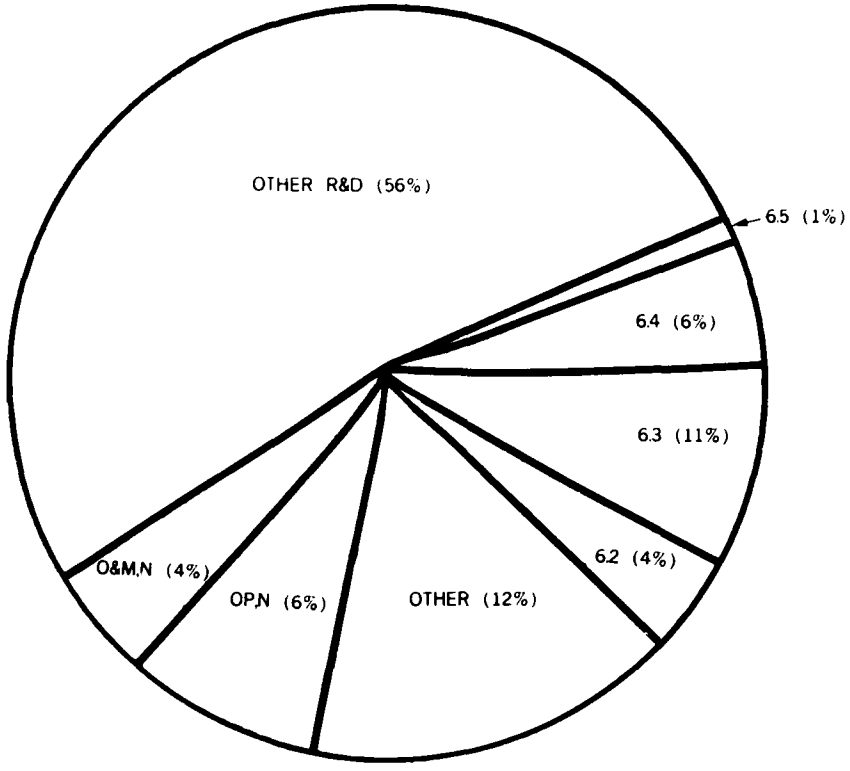
NOA -- NEW OBLIGATIONAL AUTHORITY

NAVEODTECHCEN

NOA

FUNDING BY APPROPRIATION

FY 87



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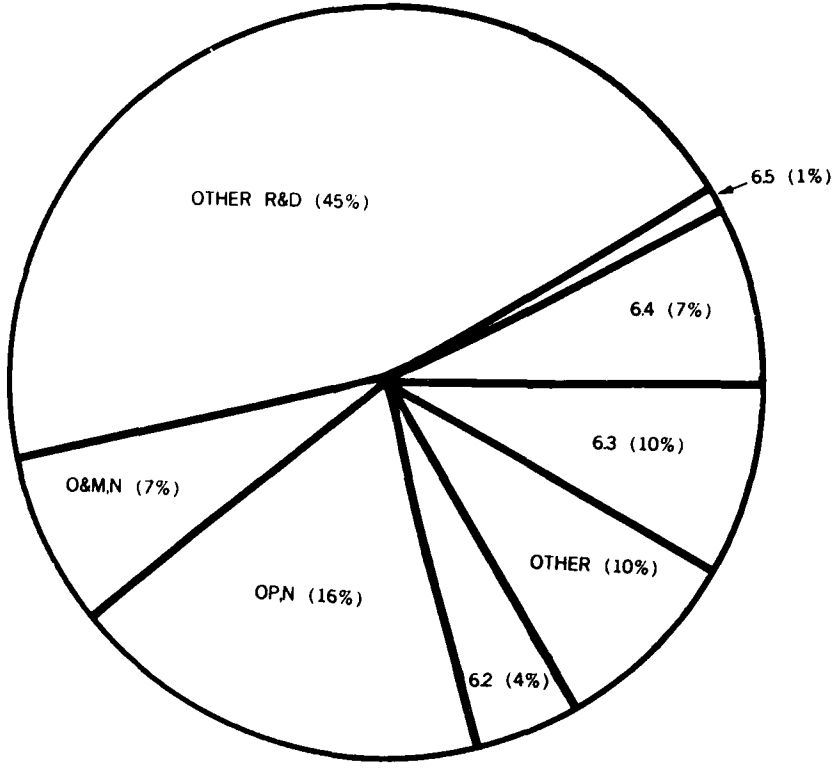
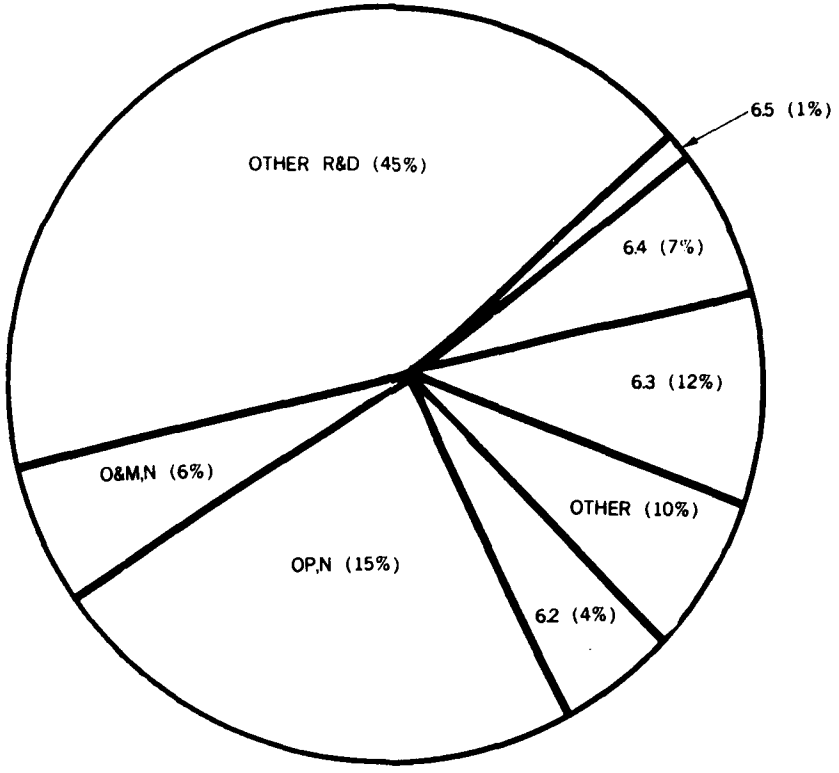


30 SEPTEMBER 1987

FUNDING BY APPROPRIATION
(Continued)

FY 89



NOA – NEW OBLIGATIONAL AUTHORITY
O&MN – OPERATION & MAINTENANCE, NAVY
OPN – OTHER PROCUREMENT, NAVY

FUNDS BY CATEGORY & TYPE
$M

CATEGORIES AND TYPE BY APPROPRIATION		FY 87			FY 88			FY 89		
		$M ACT.	% OF		$M ACT.	% OF		$M ACT.	% OF	
			RDT&E	TOTAL		RDT&E	TOTAL		RDT&E	TOTAL
6.2	EXPLORATORY DEVELOPMENT	3.3	17.7	3.8	3.3	20.0	4.1	3.8	19.7	4.7
6.3	ADVANCED DEVELOPMENT	9.9	53.2	11.5	7.6	46.1	9.5	9.7	50.3	12.0
6.4	ENGINEERING DEVELOPMENT	5.1	27.5	5.9	5.4	32.7	6.8	5.4	28.0	6.7
6.5	MANAGEMENT AND SUPPORT	.3	1.6	.4	.2	1.2	.3	.4	2.0	.5
	TOTAL DIRECT RDT&E	18.6	100.0	21.6	16.5	100.0	20.7	19.3	100.0	23.9
OTHER R&D	REIMBURSABLE OTHER RDT&E	48.2		55.8	36.4		45.7	36.5		45.2
O&M,N	O&M, NAVY	3.8		4.4	5.8		7.3	4.9		6.1
OP,N	OPN, NAVY	5.4		6.3	13.0		16.3	12.0		14.9
OTHER	OTHER	10.3		11.9	8.0		10.0	8.0		9.9
TOTAL OTHER APPROPRIATION		67.7		78.4	63.2		79.3	61.4		76.1
	GRAND TOTAL	86.3	100.0	100.0	79.7	100.0	100.0	80.7	100.0	100.0

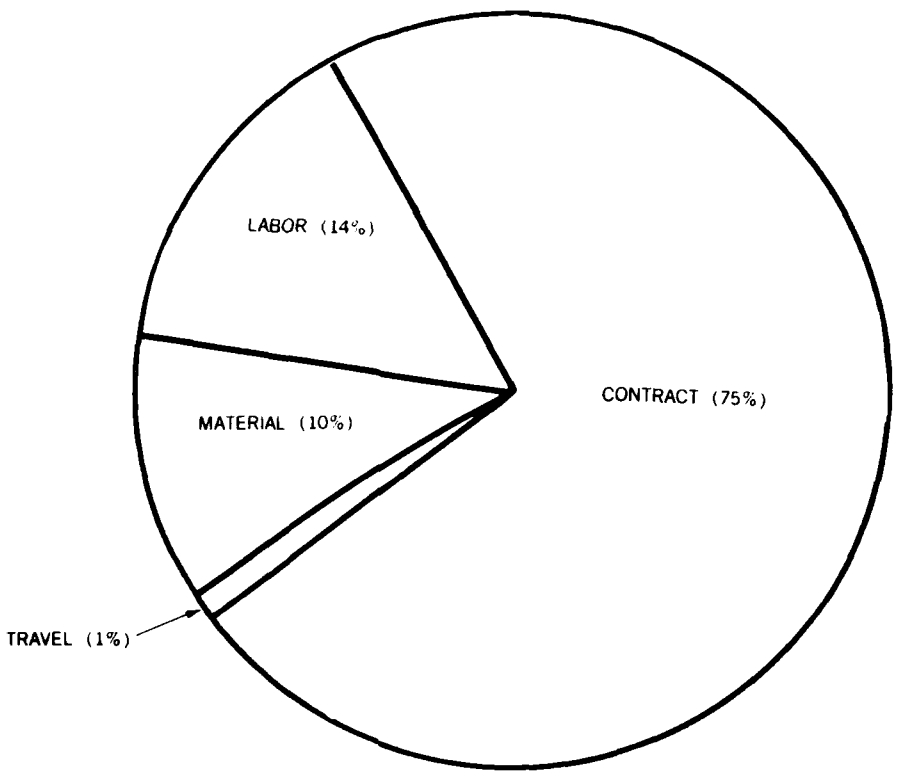
NOA – NEW OBLIGATIONAL AUTHORITY
RDT&EN – RESEARCH, DEVELOPMENT TEST & EVALUATION
O&MN – OPERATION & MAINTENANCE, NAVY
OPN – OTHER PROCUREMENT, NAVY

NAVEODTECHCEN

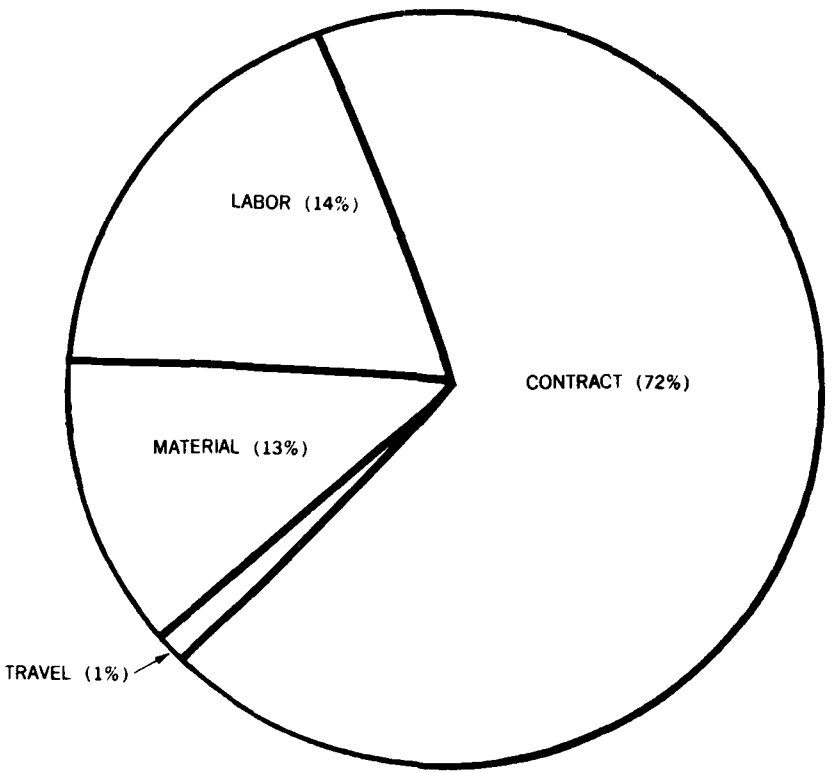
NOA

DISTRIBUTION OF FUNDS

FY 87



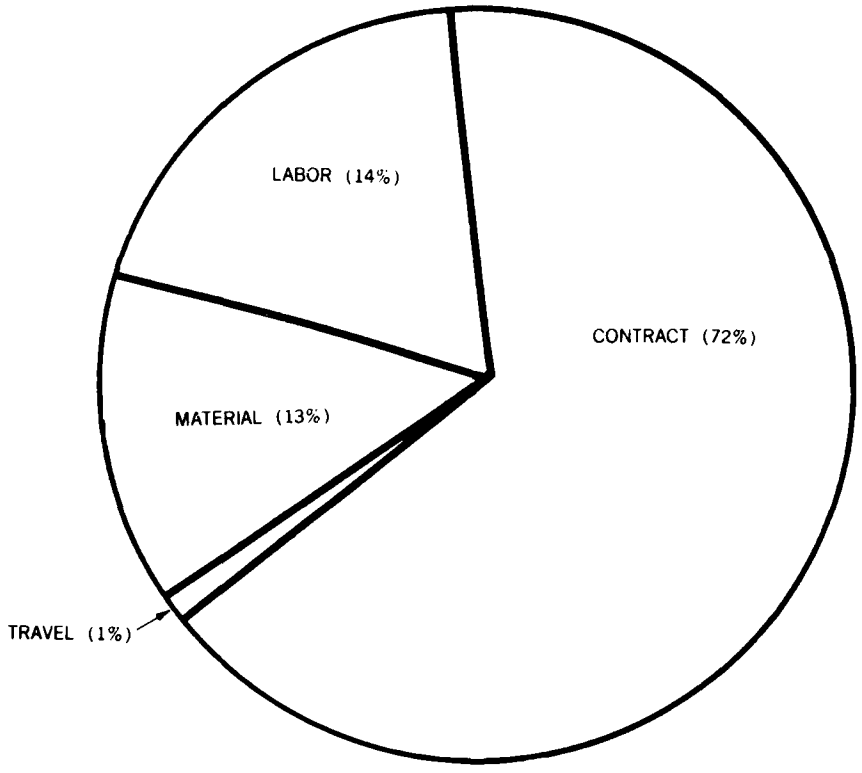
FY 88



30 SEPTEMBER 1987

DISTRIBUTION OF FUNDS
(Continued)

FY 89



NOA – NEW OBLIGATIONAL AUTHORITY

FUNCTIONS AND RESPONSIBILITIES

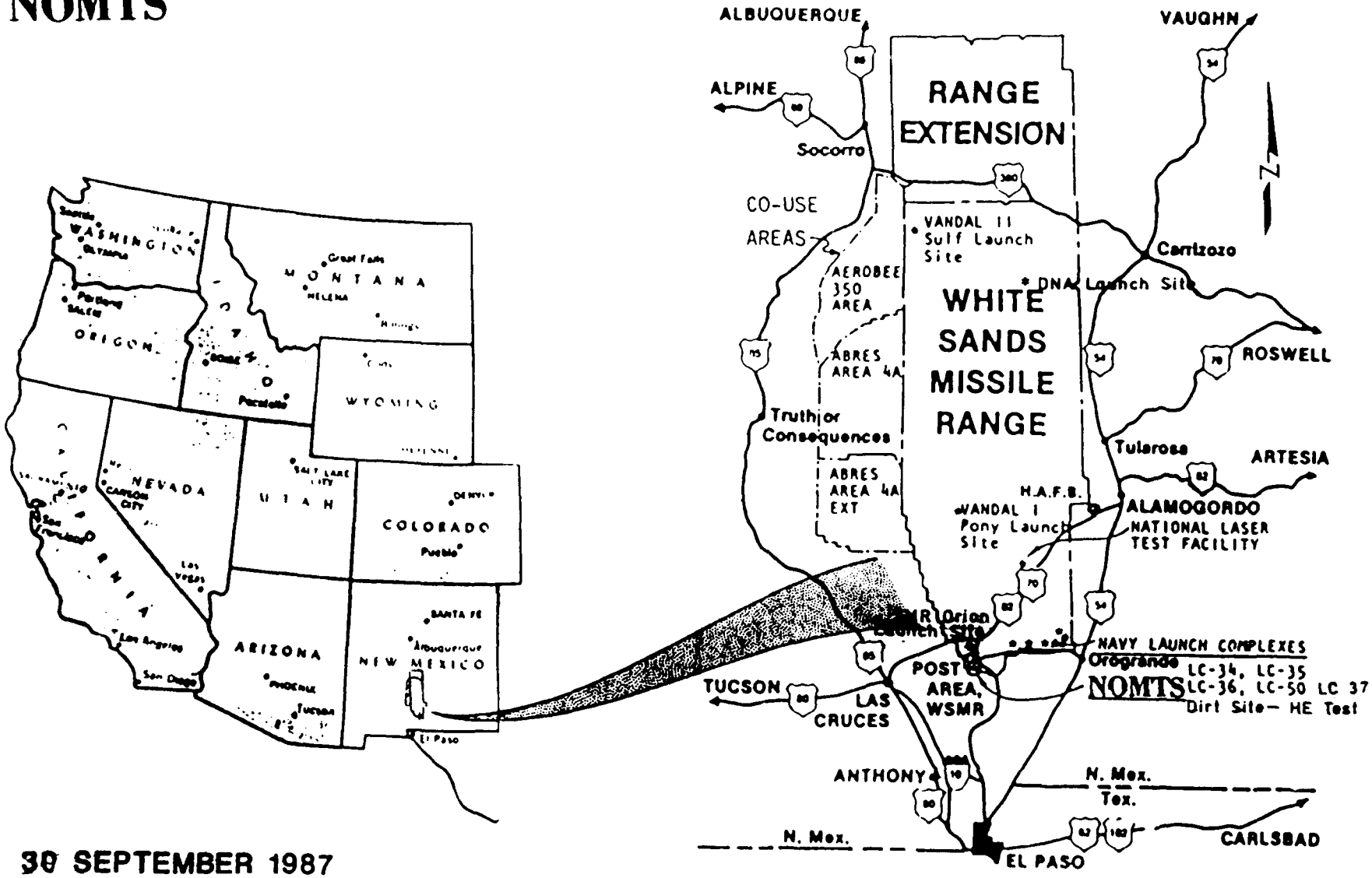
- Conduct exploratory, advanced, and engineering development leading to the design of special tools and equipment for use in the detection and location, access, identification, render safe, recovery, and disposal of all types of explosive ordnance.
- Conduct an acquisition program for domestic and foreign munitions of all types to provide a data/munitions base to prepare, maintain, and update EOD publications for Joint-service use.
- Conduct engineering development of EOD procedures. Prepare, publish, maintain, stock, and issue EOD publications for Joint-service use.
- Conduct validation of EOD procedures.
- Conduct initial evaluation of foreign explosive ordnance and develop initial render safe procedures.
- Obtain and/or prepare training aids for the Naval School, EOD and fleet EOD Groups.
- Prepare and maintain documentation for EOD tools and equipment.
- Establish and maintain a unified procurement system for special EOD tools and equipment in Federal Stock Classes 1385 and 1386. Act on waiver or deviation requests from contractors during procurement of these tools and equipment.
- In coordination with the cognizant Inventory Control Point and NAVSEASYSCOM, provide for the preparation and maintenance of Wholesale Inter-Service Supply Support Agreements (WISSA) between the Services for EOD tools and equipment.
- Maintain archival record copies of EOD publications.
- Provide special EOD services to the U.S. Army Toxic and Hazardous Materials Agency.
- Conduct exploratory and engineering development of technology and equipment for the support of EOD access to and rendering safe of improvised nuclear devices.
- Conduct technical evaluation of EOD tools and equipment.
- Periodically brief staff and students of the Naval School, EOD on new EOD developments.
- Conduct and coordinate depot-level maintenance for assigned Navy EOD tools and equipment, other Service EOD tools and equipment as assigned in accordance with Depot Maintenance Inter-Service Support Agreements (DMISA), and assigned Swimmer Weapons Systems (SWS) equipment.
- Conduct first article inspection and production lot acceptance testing of special EOD tools and equipment, under the cognizance of NAVSEASYSCOM, being procured for all Services. Conduct a standardized surveillance program for Navy EOD tools and equipment to ensure compliance with quality standards.
- Conduct in-service engineering for EOD tools and equipment and SWS equipment under the cognizance of NAVSEASYSCOM.
- Under the cognizance of NAVSEASYSCOM, ensure the attainment of approved emergency and wartime requirements by providing for stocking, storing, and maintaining specified Navy EOD Prepositioned War Reserve Stock (PWRS).
- Provide support to resident Service Detachments as mutually agreed by host-tenant agreements.
- Receive, maintain under proper surveillance, and account for explosives, explosive ordnance material, and special tools and equipment required to accomplish the assigned mission.
- Serve as a focal point for range clearance technology for Navy and Marine Corps activities.
- Maintain technical expertise for exploitation of all classes of foreign ordnance material.
- Maintain a "quick response" scientific team with specialized laboratory equipment for deployment in countering a terrorist improvised nuclear device threat.

NAVAL ORDNANCE MISSILE TEST STATION

BRIEF

WHITE SANDS MISSILE RANGE
NEW MEXICO

NOMTS



30 SEPTEMBER 1987

NOMTS

MISSION

PROVIDE QUALITY AND RESPONSIVE TECHNICAL AND MATERIAL SUPPORT TO THE FLEET FOR LAND BASED FLIGHT TEST AND EVALUATION OF SURFACE WEAPON SYSTEMS; DIRECTED ENERGY WEAPONS TEST AND EVALUATION; AND PARTICIPATE IN THE OPERATION OF THE DEPARTMENT OF DEFENSE MISSILE TEST RANGE AT WHITE SANDS AS ASSIGNED BY COMMANDER, NAVAL SEA SYSTEMS COMMAND.

30 SEPTEMBER 1987

NOMTS

INTRODUCTION

The Naval Ordnance Missile Test Station (NOMTS) is a tenant command on the US Army operated White Sands Missile Range, (WSMR) NM, located approximately 25 miles east of Las Cruces, NM and 40 miles north of El Paso, TX. NOMTS is situated 32°24'15" latitude and 106°20'31" longitude.

The WSMR was officially established on 9 July 1945 as White Sands Proving Ground. NOMTS was established on 14 June 1946 to participate with the US Army in research studies and test firings of captured German V-2 Rockets. Shortly thereafter, NOMTS commenced independent tests of the Navy's VIKING rocket which contributed to the success of the Naval Research Laboratory's VANGUARD rocket program. During the late 1940's, the Station was involved primarily in launching Sounding Rockets for atmospheric research. Over 1005 Sounding Rockets have been launched by NOMTS to date at WSMR.

Early in 1950, the Navy's effort at White Sands was increased substantially by involvement in the Research, Development, Test and Evaluation of the TALOS Ramjet Surface-to-Air missile and its Fire Control System. The first TALOS missile firing was conducted 10 July 1951; testing continued into the 1970's. This early effort was followed by extensive TERRIER, TARTAR, STANDARD, AEGIS and RAM missile engineering development program test and evaluation flights at White Sands Missile Range (WSMR).

In February 1984, the Navy High Energy Laser Program Office Detachment, WSMR, merged with NOMTS adding test support of Directed Energy Weapons to the Station's mission and resulted in the Command name change to Naval Ordnance Missile Test Station. The Navy High Energy Laser (HEL) activity supports the Strategic Defense Initiative through test and evaluation of this emerging technology.

NOMTS today, is the NAVSEA Center of Excellence for Land Based Testing of Surface Launched Weapon Systems and for Directed Energy Weapon Test and Evaluation.

NOMTS is the Land Based Test Site for STANDARD MISSILE and is the Navy's only test station capable of firing all versions of STANDARD MISSILE (SM-1/SM-2/MR/ER) including Vertical Launched STANDARD, AEGIS, and TERRIER/TARTAR missiles. NOMTS is also the Land Based Test Site for the Rolling Airframe Missile (RAM) and Vertical Launch ASROC (VLA). Land based test of numerous other systems is supported including SEA LANCE, 5" Guided Projectile, TOMAHAWK, NATO AAW, and others.

NOMTS has field support responsibility for the MIRACL HEL and SEA LITE BEAM DIRECTOR (SBLD) and conducts all WSMR testing in support of the Navy's SKYLITE Program and Balanced Technology Initiative Program. The MIRACL HEL is also operated by the Navy in support of HEL testing directed by the Army for numerous other users.

30 SEPTEMBER 1987

NOMTS

INTRODUCTION

NOMTS continues providing Sounding Rocket Launch Support for NASA, the Air Force Geophysics Laboratory, and Naval Research Laboratory Upper Atmospheric Sounding Rocket Programs. An increase in workload in this Specialty Area is currently being experienced due to use of the Aries Sounding Rocket in support of several SDI programs. Level of effort due to SDI is expected to increase further into the 1990's.

The sponsor and primary user of the Station is Naval Sea Systems Command, however, Naval Space and Warfare Command, Naval Air Systems Command and NASA also use NOMTS services. The majority of funding is provided by direct support funds from the STANDARD MISSILE, RAM and Naval Space and Warfare Systems Command, NASA and NAVAIR.

NOMTS has an authorized military-civilian staff of 152 personnel with a budget of $17.3 million.

30 SEPTEMBER 1987

NOMTS

FACILITIES

Many unique major weapons test facilities are available at NOMTS with extensive test support and instrumentation services. These facilities include the following:

- Launch Complex 34 - This complex is the Land Based Test Site for the Rolling Airframe Missile (RAM) System. Completed in 1980, this Facility is outfitted with a complete system of sensors, fire control, weapons control, and launchers for all configurations of RAM. The System functionally and physically duplicates the shipboard RAM system.

- Launch Complex 35 - Known as the USS Desert Ship, LLS-1, this facility just completed a multimillion dollar upgrade and is used in the testing of most Navy Surface-to-Air and other missile systems including AEGIS, TERRIER, TARTAR, Vertical Launch ASROC, and NATO AAW. The Desert Ship functionally duplicates all fire control and weapons control requirements of a surface ship. Dedicated telemetry, target monitoring, data extraction and reduction systems complement the extensive instrumentation services provided by the Range. A MK 39, 5"/54 Gun Mount is available for test firing 5" munitions including the Semi-Active Laser Guided Projectile.

- Launch Complex 36 - This complex, as well as a portion of Launch Complex 35, provides three sites for launching of Upper Atmosphere Sounding Rockets. The complex includes a variety of launch pads, blockhouses, and seven launchers which can be configured for testing of various missiles and rockets.

- Launch Complex 50 - This complex supports RAM firings against the VANDAL Target. A remote, hardened site was required to safely allow self defense testing against high speed, low altitude targets at short ranges. (This is an Army facility, occassionally used by the Navy.)

- VANDAL Launch Complexes - VANDAL is a Navy target missile (former TALOS) used to test RAM and STANDARD missiles against supersonic threat representative targets. Two launch complexes afford the flexibility and versatility of threat trajectories to test these and other Navy missiles.

- DIRT SITE - A dedicated land area used by the Naval Explosive Ordnance Disposal Technical Center to conduct Ordnance Disposal Evaluation experiments and proofing of ordnance disposal techniques and to obtain burning characteristics of aircraft bombs and other Ordnance. Electrical power and instrumentation sites are provided.

30 SEPTEMBER 1987

NOMTS

FACILITIES

- HIGH ENERGY LASER SYSTEM TEST FACILITY (HELSTF) - HELSTF is managed by WSMR and has been designated as the National Laser Test Range to support all three services and DARPA. The Navy has installed the nation's most powerful continuous wave high energy laser (MIRACL) and the SEA LITE BEAM DIRECTOR (SLBD), the largest beam director built in the free world. NOMTS conducts tests and evaluations in support of development and laser vulnerability programs.

All Facilities are located on White Sands Missile Range which is situated in the Tularosa Basin of South-Central New Mexico.

LAND OWNED
95.39 Acres
4,155,188 Sq.Ft.

AQUISITION COSTS	
Real Property	$6,775,429
Equipment	$6,507,580
Industrial Plant Equip.	$505,555

BUILDINGS	SQ. FT.
RDT&E	66,411
Administrative	29,165
Other	84,048

30 SEPTEMBER 1987

NOMTS

PROGRAM WORK

(FY 87)

PROGRAMS	TOTAL MISSIONS	FIRING/TESTS
STANDARD MISSILE	17	3
ROLLING AIRFRAME MISSILE	9	9
HIGH ENERGY LASER	70	32
NAVY AIR WEAPONS TEST (NWEF)	69	69
REASEARCH ROCKETS	44	8
MISCELLANEOUS	15	4
	224	125

30 SEPTEMBER 1987

NOMTS

MAJOR ACCOMPLISMENTS

FY 86

* SM-2 BLOCK II (ER). A warhead configured Production Surveillance Round was fired against a high altitude Vandal target. This round was configured with new thermally insulated sustainer motors. Direct kill was achieved.

* SM-2 BLOCK II AEGIS/VLS. Two AEGIS warhead rounds were fired from the MK 41 vertical launching system. Both rounds were fired against a ground jammer target surrounded by a warhead test arena. Dynamic warhead data were obtained and the rounds demonstrated minimum range and over-the-shoulder capabilities.

* The 5" Guided Projectile (DEADEYE) project renewed testing after several years. Several ballistic and telemetry rounds were successfully fired from the MK 39 5"/54 gun at the Desert Ship.

* DIRECTED ENERGY WEAPONS PROGRAM. Successful integration of the Sealite Beam Director and MIRACL laser was completed and full power testing accomplished. Several vulnerability test programs were completed in support of the Strategic Defense Initiative. Installed the first phase of beam cleanup adaptive optics.

FY 87

* STANDARD MISSILE. A blast test missile and three SM-1 missiles were successfully fired from the Desert Ship. These firings verified the upgrade of the firecontrol system and the new installation and operation of the MK5 MOD 3 rail launcher.

* DIRECTED ENERGY WEAPONS PROGRAM. Major upgrade to the laser adaptive optics system was completed in preparation for numerous high power SDI related tests. Long range irradiance measurements, battlefield smoke penetration tests and several lethality tests were successfully conducted. High power dynamics tests using the Sealite Beam Director were conducted against an instrumented flying target array which led to the first successful kill of a subsonic BQM-34 target drone.

* VERTICAL LAUNCH ASROC (VLA). Integration of the MK 41 VLS and the VLA computer program was completed and a successful non-propulsive vehicle test was completed.

* IMPROVED TOW. Three shipboard storage compatibility/sympathetic detonation tests of the improved TOW missile were successfully completed. This demonstration was required for safety review board approval prior to stowage and transport aboard US Navy ships.

30 SEPTEMBER 1987

NOMTS

MAJOR ACCOMPLISMENTS

FY 86

* ROLLING AIRFRAME MISSILE. RAM sucessfully demonstrated missile capabilities against BQM-34D's in the RF-IR Handover Guidance Mode. Two instrumented test vehicles and two flight test rounds were successfully fired.

* Reasearch Rockets Division successfully launched 14 sounding rockets including 2 ARIES, 2 NIKE ORIONS and 10 NIKE BLACK BRANTS, supplying direct support to NASA and numerous universities for a wide range of scientific experiments.

FY 87

* NATO AAW. The first contractor demonstration was successfully completed proving the feasibility of dense packing Seasparrow missiles and launching them from the MK 41 Vertical Launching System.

* EXPLOSIVE ORDNANCE DISPOSAL. New render safe procedures for large munitions were successfully demonstrated using the jet perforator, which was designed by NAVEODTECHCEN, Indian Head.

* DEFENSE NUCLEAR AGENCY. Four rocket laurchers were designed, refurbished and installed at DNA's permanent high explosive test site. The launchers were used to fire 20 VIPER and 4 TALOS/TERRIER rockets in rapid sequence in support of experiments during operation MISTY PICTURE.

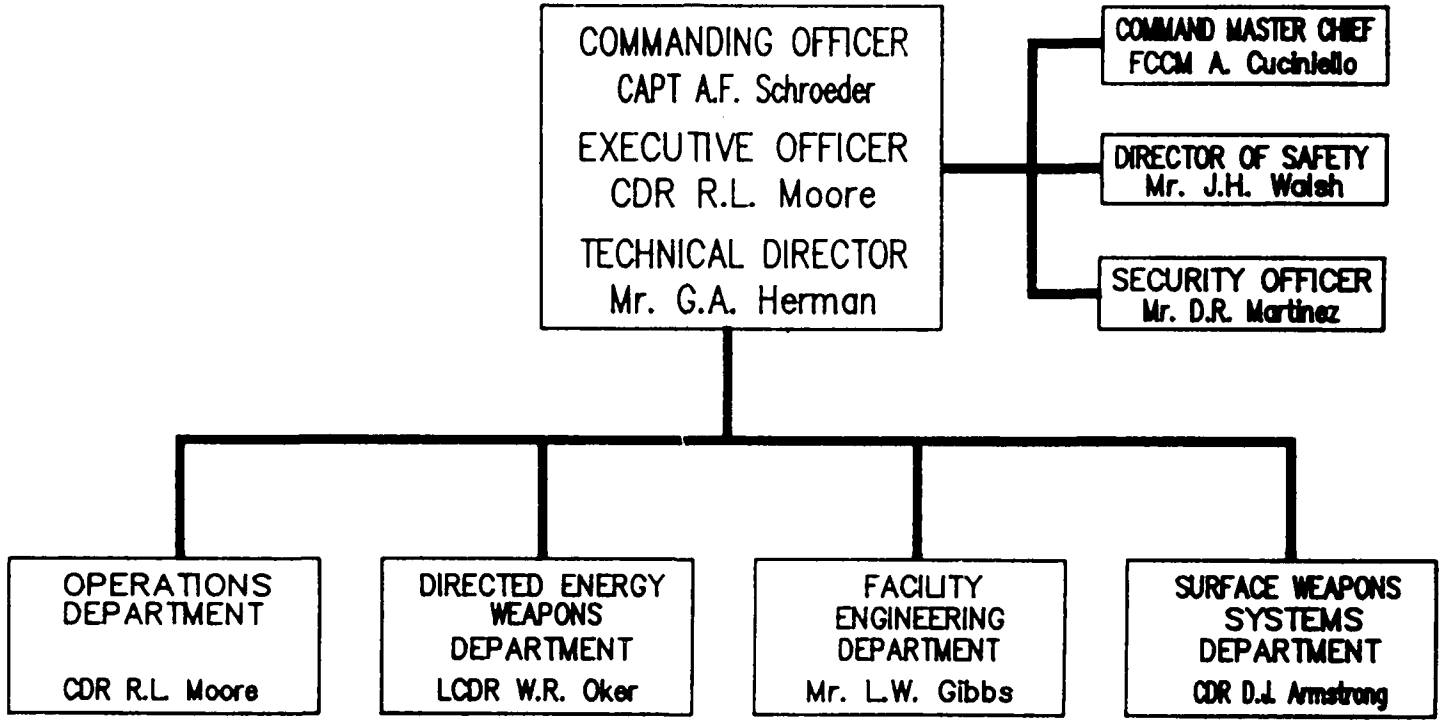
* ROLLING AIRFRAME MISSILE. Completed Phase I of DT/OT with several successful firings against BQM-34 drones and supersonic VANDAL targets. Program was authorized to start pre-production. The Design Improvement Program completed Phase II that included cannister modifications. Two blast effects tests were completed to study the impact on German mines.

* RESEARCH ROCKETS. A significant improvement to research rockets guidance was achieved when the first launch of a TERRIER BLACK BRANT with an S-19 guidance package was successfully completed. The improved trajectory accuracy allows flights without the requirement for off-range evacuations. We fired 4 NIKE BLACK BRANT, 3 TERRIER BLACK BRANT and 1 TAURUS ORION rockets.

30 SEPTEMBER 1987

NOMTS

NAVAL ORDNANCE MISSILE TEST STATION



30 SEPTEMBER 1987

NOMTS

PERSONNEL DATA

PERSONNEL	ALLOWANCE	ON BOARD
OFFICER	10	6
ENLISTED	83	60
CIVILIAN	59	64

FTP	TPTI	FTP UNGRADED	FTP GRADED
51	13	17	34

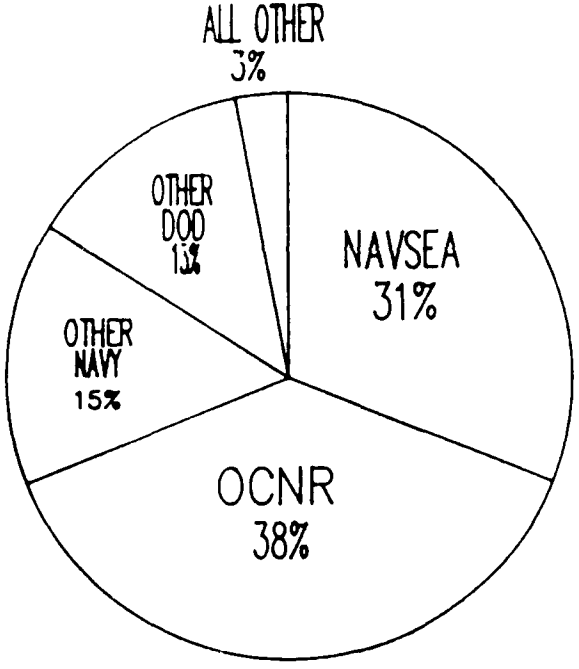
	CAMAS CODE	NUMBER
Scientist/Engineer	2000	6
Administrative	3000/4000	9
Technicians	5000	12
Clerical/Other Gen Sched	6000/7000	7
TOTAL		34

30 SEPTEMBER 1987

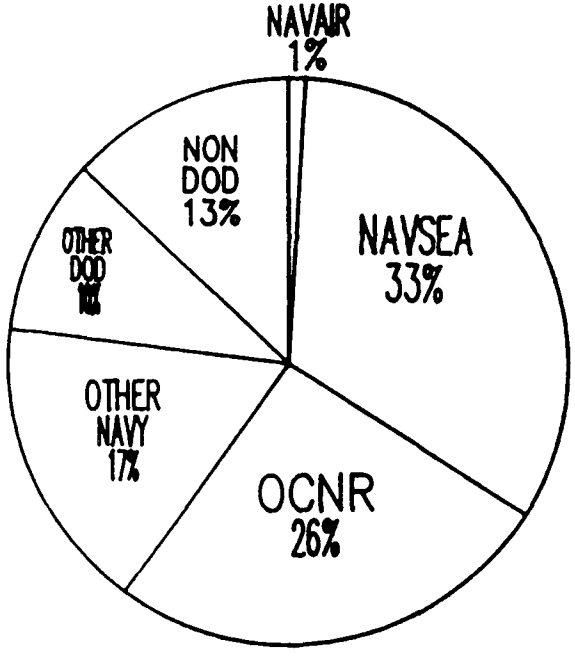
NOMTS

FUNDING BY SPONSOR

FY-87



FY-88

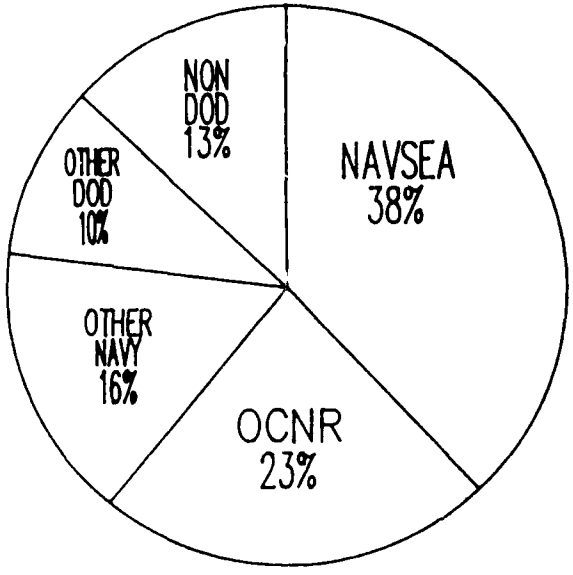


30 SEPTEMBER 1987

NOMTS

FUNDING BY SPONSOR

FY–89

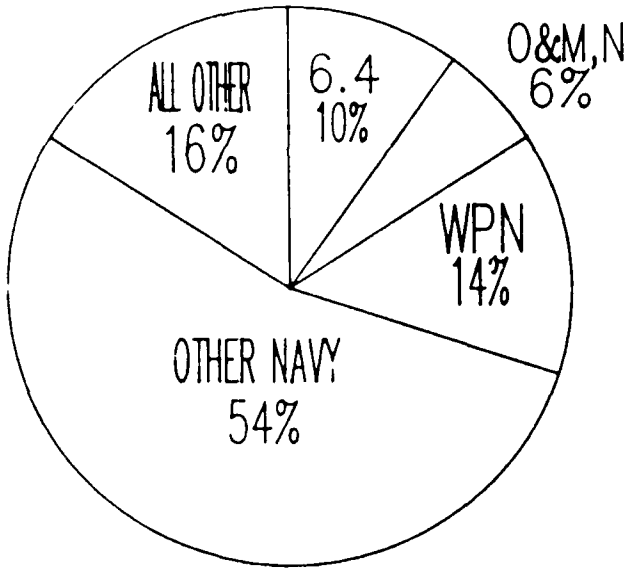


30 SEPTEMBER 1987

NOMTS

FUNDING BY APPROPRIATION

FY-87



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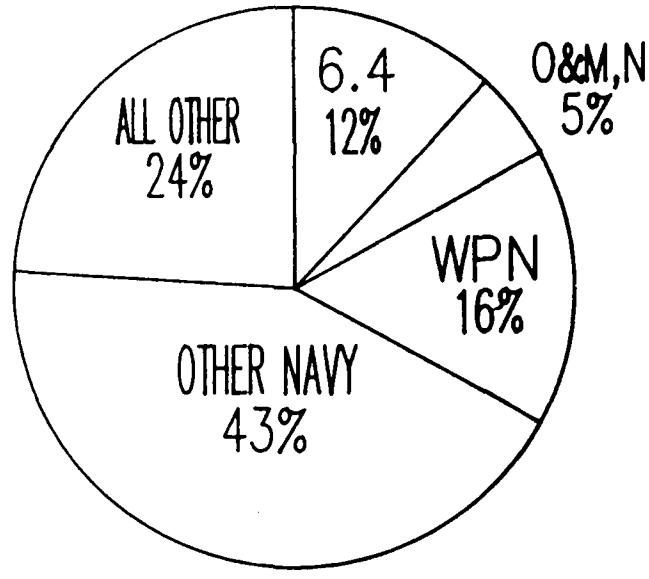
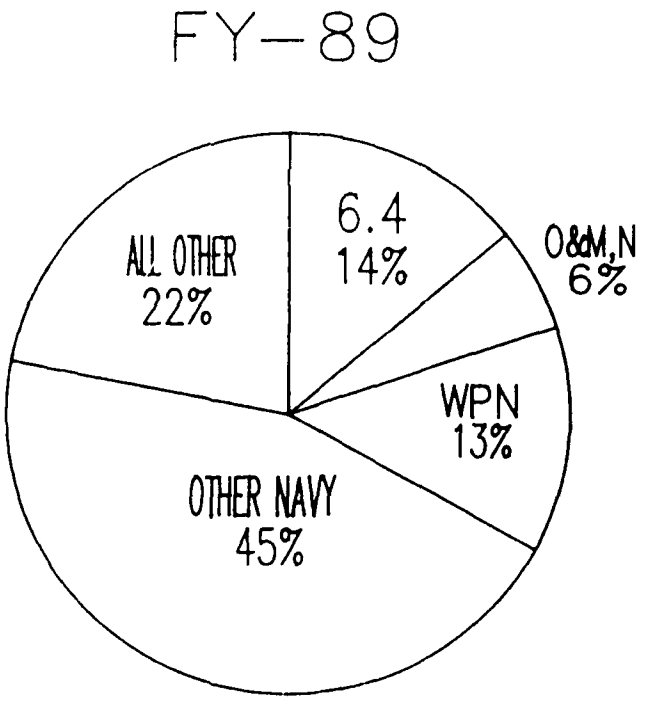


30 SEPTEMBER 1987

NOMTS

FUNDING BY APPROPRIATION



30 SEPTEMBER 1987

NOMTS

FUNDS BY CATEGORY AND TYPE

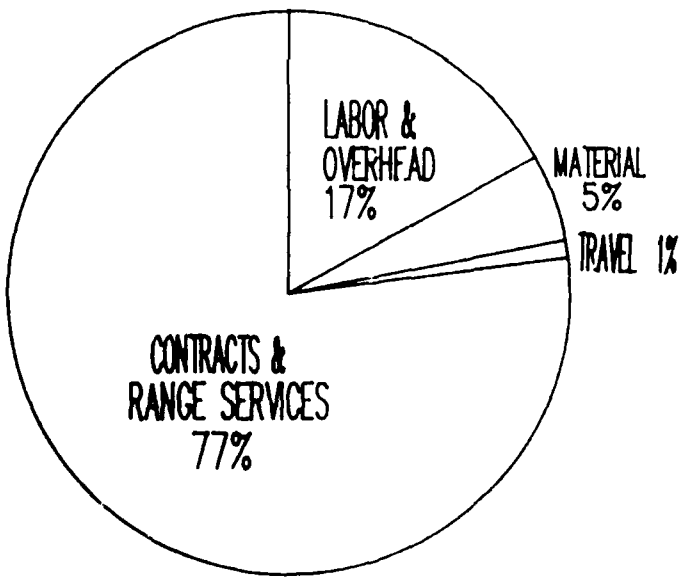
CATEGORIES AND TYPE	ST ACCT.	FY 1987 % OF RDT&E	FY 1987 % OF TOTAL	ST ACCT.	FY 1988 % OF RDT&E	FY 1988 % OF TOTAL	$T ACCT.	FY 1989 %OF RDT&E	FY 1989 %OF TOTAL
RDT&E									
6.1 RESEARCH									
6.2 EXPLORATORY DEVELOPMENT									
6.3a ADVANCED TECHNOLOGY DEVEL.									
SUB TOTAL									
6.3b ADVANCED DEVELOPMENT									
6.4 ENGINEERING DEVELOPMENT	1.3	.18	.09	2.3	.28	.12	2.8	.34	.14
6.5 MANAGEMENT AND SUPPORT									
6.6 OPERATIONAL SYSTEMS DEVEL.									
SUB TOTAL	1.3	.18	.09	2.3	.28	.12	2.8	.34	.14
OTHER RDT&E	6.0	.82	.44	6.0	.72	.32	5.5	.66	.26
TOTAL RDT&E	7.3	1.00	.53	8.3	1.00	.44	8.3	1.00	.40
(O&MN) OPER. & MAINT. NAVY									
(APN) AIRCRAFT PROCUREMENT NAVY									
(WPN) WEAPONS PROCUREMENT NAVY	1.9	------	.14	3.0	-----	.15	2.8	------	.14
(SCN) SHPBLD & CONVER. NAVY									
OTHER NAVY	2.2	------	.16	3.2	-----	.17	5.0	------	.24
ALL OTHER	2.4	------	.17	4.5	-----	.24	4.6	------	.22
OTHER APPROPORIATE SUBTOTAL	6.5		.47	10.7		.56			.60
GRAND TOTAL	13.8		1.00	19.0		1.00	20.7		1.00

30 SEPTEMBER 1987

NOMTS

DISTRIBUTION OF FUNDS

FY-87



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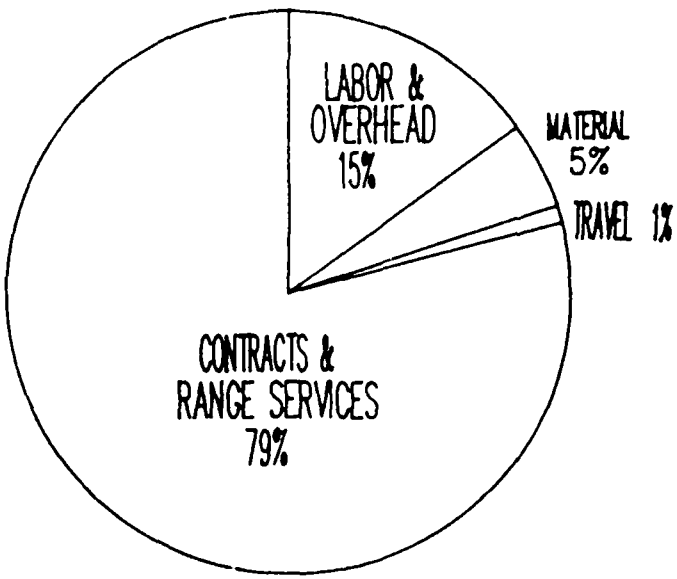
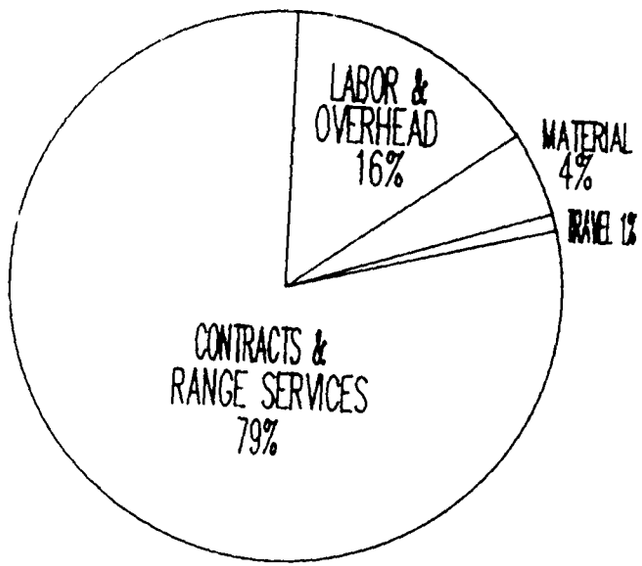


30 SEPTEMBER 1987

NOMTS

DISTRIBUTION OF FUNDS

FY-89



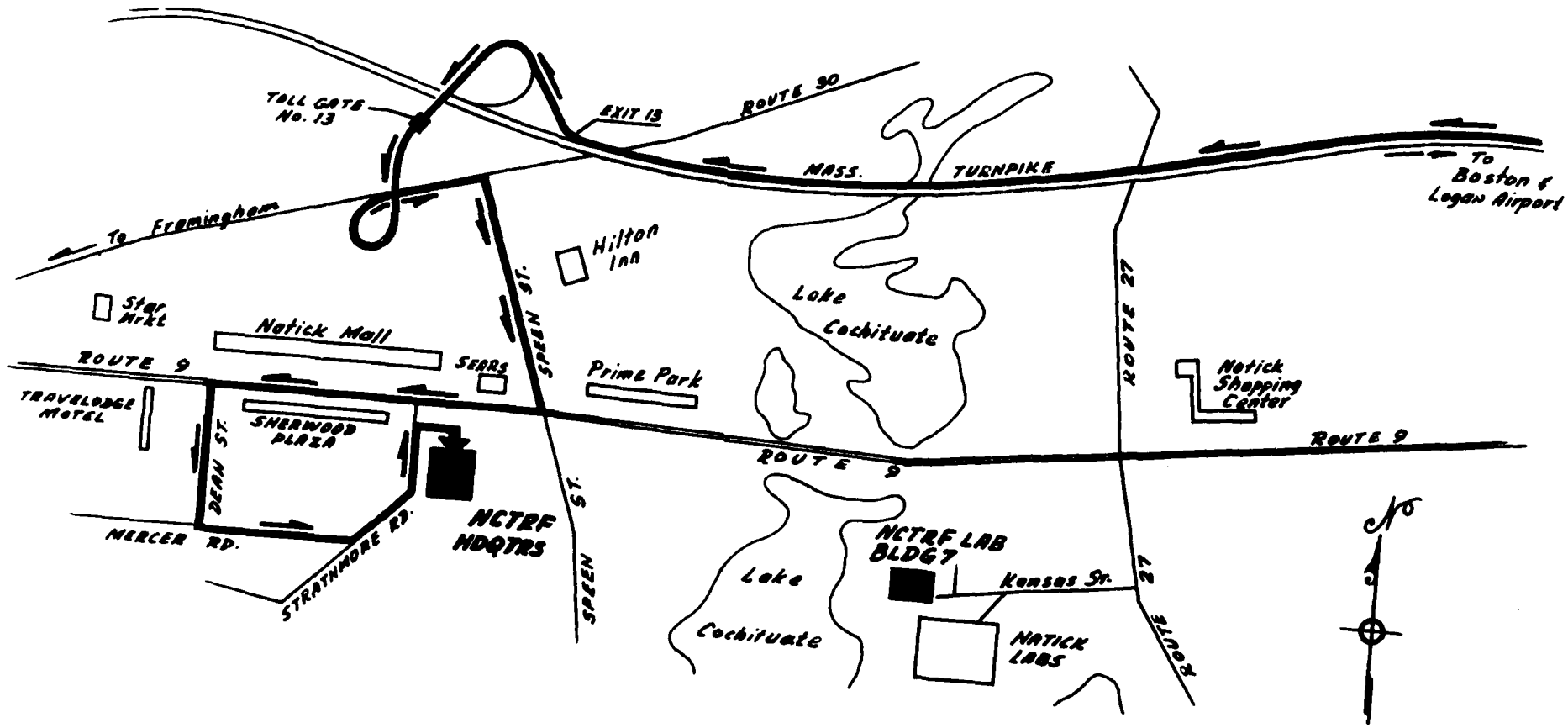
30 SEPTEMBER 1987

NAVY
CLOTHING AND TEXTILE
RESEARCH FACILITY

NATICK, MASSACHUSETTS

BRIEF

NCTRF



30 SEPTEMBER 1987

NCTRF

MISSION STATEMENT

CONDUCT RESEARCH, DEVELOPMENT, TEST AND EVALUATION AND PROVIDE ENGINEERING SUPPORT IN CLOTHING, TEXTILES, AND RELATED FIELDS ASSOCIATED WITH SERVICE CLOTHING AND ENVIRONMENTAL PROTECTIVE CLOTHING

30 SEPTEMBER 1987

NCTRF

INTRODUCTION

The Navy Clothing and Textile Research Facility (NCTRF), Natick, Massachusetts, designs and develops all protective clothing, dress uniforms and utility garments worn by most Navy personnel. Consequently, it conducts research on fabrics and materials which it develops into clothing items that it tests and evaluates before introduction to the Fleet.

Fire-preventive clothing, cold-weather garments, women's wear, battle dress clothing, boots and shoes, insignia, life-support systems, submarine-deck exposure suits, handwear, and dress and work uniforms are only some of the products developed by NCTRF.

Located 20 miles west of Boston, NCTRF consists of five divisions, each of which performs a vital role in creating more attractive, functional, and durable garments for the Navy man and woman. The Materials Research Division analyzes the base fabric for a proposed item, the Clothing Development Division makes and field tests the prototype, the Environmental Sciences Division performs engineering and physiological test and evaluation of the item, and the Standardization and Specifications Division issues the requirements for future manufacture of the prototype. Finally, the Technical Support Division, located at the Defense Personnel Support Center (DPSC), in Philadelphia, works with DPSC and other agencies to supply the new product to the Fleet.

The NCTRF laboratory complex, located 3 miles from NCTRF headquarters, houses extensive engineering, physiological, and materials test facilities. Among the laboratories are the Environmental Test Chamber Laboratory that reproduces temperature and relative humidity extremes ranging from -40 degrees to 200 degrees F at 5 to 100% RH, and the Hydro-Environment Simulator Laboratory that reproduces air-sea surface temperature conditions existing anywhere on earth.

As of 30 September 1987, NCTRF employed 59 civilians and 1 military officer. Its total funding for FY 1987 was over $3.5 million. Most of this funding was received from the Naval Supply Systems Command, NCTRF's major sponsor. Other funding sources were: the Naval Sea Systems Command, the Navy International Logistics Control Office, the U.S. Coast Guard, and the U.S. Air Force.

30 SEPTEMBER 1987

NCTRF

HISTORY

NCTRF traces its origins to the Clothing Manufacturing Department of the Naval Clothing Depot, Brooklyn, which began operations in 1879. At that time, the forerunner of NCTRF was named the Inspection Division. The division's personnel inspected materials in bale, yarn, fabric, and garment form, developed inspection techniques, and worked with industry to introduce new materials.

In 1943, a Textile and Clothing R&D Department was formed, which included many personnel from the old Inspection Division. This new department, which contained a Clothing and Textile Research Division and a Specifications and Standards Clothing Research Division, eventually became the research arm of the Clothing Supply Office (CSO), which was established in 1947. Shortly thereafter, when industry focused its interest on the highly profitable civilian clothing market, military procurement problems arose. In response, the Textile and Clothing R&D Department helped to establish a Technical Division under CSO, which became the first point of reference for all procurement problems concerned with clothing research and development.

In 1952, the R&D Department became a division of the CSO, and the Technical Division was later merged into the R&D Division. When the CSO was reorganized in 1958, the Clothing and Textile Research and Development Division remained in Brooklyn, but became a division of the Naval Supply Research and Development Facility, Bayonne, New Jersey. It moved to Bayonne in 1962.

In 1967, when the Bayonne supply facility closed its doors, the Clothing and Textile R&D Division was renamed the Navy Clothing and Textile Research Unit and was relocated in Natick, Massachusetts. Finally, in March 1976, the unit received its current title, the Navy Clothing and Textile Research Facility.

Through the years, NCTRF research scientists have developed the thermal, waffle-weave, cold-weather underwear, and the vapor barrier "Mickey Mouse" boot. They are currently advancing the state-of-the-art in firefighters' protective clothing, battle dress clothing, anti-exposure suits, cold-weather and shipboard protective wear, and life-support systems and equipment.

Meanwhile, NCTRF clothing designers and technologists have refashioned the old 13-button, bell-bottom uniform for today's sailor, and, of course, continue to design all uniforms and work clothing for the Navy and the Coast Guard.

NCTRF

FACILITIES

The Hydro-Environment Simulator Laboratory can reproduce air-sea interface temperature conditions existing anywhere on earth. The air chamber and marine tank combination permits simulation of temperature variations from the Arctic Ocean (air, -40 degrees F; sea, 28 degrees F) to the Red Sea (air, 120 degrees F; sea, 110 degrees F). Physiological tests in this laboratory were instrumental in the development of the submarine-deck exposure suit.

The Environmental Test Chamber Laboratory reproduces extremes of environmental conditions with temperature and relative humidity controlled from -40 degrees F to 200 degrees F at 5 to 100 percent RH. Different types of human work activities at different levels of work loads are simulated by use of a treadmill with variable speeds and inclinations, step tests, and other work tasks as needed. A heat lamp bank simulates radiant solar heat load. During testing, the physiological responses of test subjects are monitored through thermocouples applied to various parts of the body. The laboratory has been used in developing extreme and intermediate cold-weather clothing, firefighters' ensembles, and the portable, dry-ice, liquid-pulse-pump cooling system that can be used by a ship's engine- and boiler-room personnel to combat heat stress.

NCTRF engineers have created a unique thermal manikin that will permit NCTRF to evaluate the thermal protection of clothing and diving suits in water as well as cold air. The manikin, which simulates metabolic heat, has 10 independently heated and controlled sections made from aluminum castings. A pressure equalization system permits immersion of the manikin in water environments equivalent to submersion in 300 meters of sea water.

The Thermal Flammability Laboratory comprises: (1) the unique fire simulator apparatus that provides controlled thermal energy in the forms of infrared radiant and convective heat on fabrics and fabric insulation assemblies for firefighters' clothing; (2) the thermal protection performance tester that measures both radiant and convective heat associated with fire-retardant materials; (3) infrared radiant heat test apparatus for firefighters' fabrics; (4) standard test equipment for direct flame tests. With this equipment, the laboratory can evaluate the effects of thermal energy on fabrics in the form of flame and of conductive, convective, and radiant heat. It can determine and evaluate the relationship of heat conduction in fabric assemblies (that is, clothing) to the probable effects on the wearer's skin and his subsequent comfort. By evaluating the effects of direct flame impingement, the laboratory can determine ignition time, rate of burn, afterflame, afterglow, and char length of standard and experimental fabrics. As the lead laboratory in the Department of Defense for proximity firefighters' clothing, NCTRF employs this laboratory in developing fire-retardant clothing. This laboratory is now testing hood and glove materials for anti-flash gear.

30 SEPTEMBER 1987

FACILITIES (CONTINUED)

The Chemical Test Laboratory performs research, development, test and evaluation on fibers, yarns, fabrics, coatings, films, laminates, dyes, and finishes used in all types of general- and special-purpose protective clothing and textiles. It conducts investigations on dye formulations and chemical finishes for fibers, fabrics, leather and elastomeric products. This laboratory was used in the development of the torpedo handler's disposable garment for use as protection against the toxic fuel used in the Mark 48 torpedo.

The Physical Test Laboratory conducts research, development, test and evaluation on the physical properties of fibers, yarns, fabrics, and fabric blends to determine their probable end-item performance in clothing and textiles. Colorfastness, breaking strength, tear resistance, abrasion resistance, aging, weather resistance, water repellency, air permeability, adhesion, stiffness and crease resistance are many of the physical properties tested in this laboratory. In general, the laboratory: (1) investigates the effect of fiber characteristics and fabric geometry on the appearance, comfort, durability, and protective capabilities of materials; (2) originates physical test requirements for standard and experimental samples; and (3) recommends physical tests to be performed on textiles and finishes for specification or procurement purposes.

The Laundry Laboratory performs research, development, test and evaluation of the laundering and chemical effects on fabrics and clothing to determine dimensional stability, colorfastness, appearance, and durability of fabrics and fabric finishes with such properties as water repellency, soil release, flame retardance, anti-stats, and softeners. The laboratory also determines suitable laundry procedures for general and protective clothing that are subjected to shipboard and special-care laundering.

The Clothing Design and Development Laboratory designs clothing, develops patterns, and prepares prototypes of all male and female conventional uniforms and accessories, utility clothing and environmental and protective clothing for the Navy and other services. The laboratory also fabricates containers to protect electronic and other equipment against the rigors of environmental hazards.

Land Owned/Leased	1 acre
Buildings:	
Laboratory	9,186 square feet
Administrative	10,200 square feet
Other	5,630 square feet
Acquisition Costs:	
Real Property (Classes I & II)	$ 645,000
Equipment (Classes III & IV)	$1,075,000

NCTRF

PROGRAM WORK

As the principal Navy activity for conducting RDT&E of military clothing and clothing accessories, NCTRF provides technological development and support in several major program areas. The following headings represent broad fields of NCTRF research. The various sub-headings describe more specific areas of investigation.

MATERIALS RESEARCH

Clothing and Textiles
Leather
Elastomers
Coatings and Dyes
Footwear
Laundering Processes

CLOTHING DESIGN AND DEVELOPMENT

Dress Uniforms and Accessories
Utility Clothing
Environmental and Protective Clothing
Insignia
Anthropometry
Protective Containers

FIRE RETARDANCE AND HEAT RESISTANCE

Firefighters' Crash-Rescue Clothing
White Phosphorous Protective Clothing
Fire-Retardant Materials

HEAT AND COLD STRESS

Cold-Weather Clothing
Cooling Systems
Life-Support Equipment

WATER IMMERSION AND BUOYANCY

Cold-Water Exposure
Swimsuit Materials
Buoyant-Ballistic Materials

30 SEPTEMBER 1987

MAJOR ACCOMPLISHMENTS

As part of the Navy's battle-dress clothing program, NCTRF continued to develop an improved damage control ensemble and to evaluate anti-flash gear. The present damage control clothing consists of the M-1 helmet and the standard utility clothing or the aluminized coverall and hood. This ensemble is inadequate, because the utility clothing offers little protection, the aluminized clothing inhibits movement and has poor durability, and the hood limits the vision of the wearer. Therefore, NCTRF is developing the firefighter's coveralls and gloves for an improved damage control ensemble. From past test results, NCTRF has learned that personnel prefer lighter weight protective garments, which reduce the degree of heat stress. Based on FY 86 test results, NCTRF recommended the adoption of a PBI (polybenzamidazole)/ Kevlar coverall with a Nomex/Gore-Tex moisture barrier and Nomex insulation and a glove with a leather outershell, a Gore-Tex moisture barrier and a Kevlar/PBI lining. In FY 87, NCTRF assisted in purchasing 18,000 coveralls and gloves to be issued directly to shipboard personnel. Meanwhile, NCTRF has developed new anti-flash gear that can be worn by all topside crews and damage control teams. Together with the fire-retardant (FR) utility uniform, the anti-flash gear, which consists of an FR hood and gloves, achieves total body protection against flash burns and short-term exposure to fires. As a result of FY 86 firepit and manikin tests, NCTRF selected a hood made of a PBI/rayon blend and gloves of 100% FR-treated cotton. During FY 87, the Navy Sea Systems Command adopted the hood as part of the firefighter's ensemble.

As the lead laboratory in the Department of Defense for proximity firefighter's clothing and materials, NCTRF continued its development of improved firefighter's coats, trousers, hoods, and handwear. In FY 87, NCTRF continued research to improve the abrasion resistance of the highly reflective, aluminized outer layer of the proximity firefighter's clothing. Because this outer layer is very fragile, it can be worn only for a relatively short time before it must be replaced. Of course, this lack of durability results in high garment-replacement costs. Thus, NCTRF continues to experiment with applying durable types of coatings and films to the aluminized outer layer to enhance its durablity without reducing its protective capabilities. In FY 85 & 86, the two most promising abrasion-resistant materials--a Kapton film and an electron-beam cured coating--were applied to the aluminized aramid base fabric, made into proximity firefighter's garments, and tested at two Naval Air Stations and a Marine Corps Firefighting School. While both materials extended the wear time of the garments, each showed the need for more research to improve its abrasion resistance. In FY 87, NCTRF applied various protective films to Kevlar knit materials, which are more supple than the woven aluminized materials now used in the proximity firefighter's clothing. NCTRF also has developed a new firefighter's hood with a lift-up visor to replace the standard hood, which is not compatible with the self-contained breathing apparatus worn with the proximity firefighter's suit. The new hood can accommodate the breathing apparatus, has improved ventilation, and lets the wearer communicate verbally in the standby mode. In FY 87, NCTRF completed all procurement documentation so that the new hood with lift-up visor can be introduced into the DOD supply system.

MAJOR ACCOMPLISHMENTS (CONTINUED)

During FY 86 & 87, NCTRF tested a new military boot containing a direct-molded-sole welt construction with a high-compression steel toe (DMSW/HC). The DMSW/HC boot, which gives more protection for less money than the standard boot, was tested for 2 months at three Navy recruit training centers. During testing, podiatrists at RTC Orlando periodically examined the feet of the subjects for such problems as blisters, callouses, and ankle sprains. Later, they pronounced the experimental boot to be superior to the standard. By the end of FY 86, NCTRF had begun a 9-month wear test of the DMSW/HC boot aboard 15 ships, which showed the new boot was satisfactory for wear with other military footwear. Therefore, by the end of FY 87, NCTRF was preparing specification requirements that would incorporate the DMSW/HC into three styles of Navy footwear: the chukka safety shoes, the safety boots, and the aircrew safety boots.

In FY 87, NCTRF developed a fire-retardant anti-exposure suit constructed from a Nomex/Kevlar outershell and a polyvinylchloride (PVC) closed-cell foam to replace the Submarine-Deck Exposure Suit. The suit will meet cold-water immersion protection and buoyancy requirements and will offer a more functional cold-weather work ensemble for topside personnel. It also will give protection against flash fires. In FY 88, the suit will be tested in the Antarctic and aboard two ships at Norfolk, VA, in addition to physiological tests at NCTRF.

In FY 87, NCTRF evaluated the effectiveness of air and liquid microclimate cooling systems in reducing heat stress and increasing tolerance time to work in the heat. In the laboratory, air- and liquid-cooled systems were tested on subjects exercising for 2 hours at 110 degrees F and 45% relative humidity. During a 10-day field study aboard the **USS LEXINGTON**, the systems were evaluated for heat stress reduction, reliability, durability, and acceptance by shipboard personnel. Both cooling concepts effectively reduced heat stress. In the shipboard evaluation, however, the disadvantages and unpopularity of the tethered air systems made its use somewhat impractical. Of the two portables liquid-cooled systems, NCTRF recommended for near-term use the simple ice vest system, which is rugged, efficient, and virtually maintenance free.

In FY 87, NCTRF finished developing a new, fire-retardant, cold-weather ensemble. This outfit, which has a jacket, trousers, and cap, will be worn by male and female personnel aboard ship in place of the current, intermediate cold-weather (20-40 degrees F) gear. In FY 86, NCTRF ran a 6-month wear test aboard six ships and the U.S. Coast Guard cutter, **POLAR SEA**, during its 1-month expedition in the Aleutian Islands. The subjects favored the clothing with a Nomex/Kevlar outershell and a PFR/rayon fleece liner because of its durability and comfort.

MAJOR ACCOMPLISHMENTS (CONTINUED)

In FY 87, NCTRF completed evaluating fire-retardant materials for use in the officer and chief petty officer's khaki work uniform, because the current uniform is not fire-retardant. In FY 86, three materials were chosen: a Nomex/Kevlar blend; a 100% cotton fabric with an FR ammonia-cured treatment; and a 100% cotton with an FR brominated treatment. These candidate fabrics were subsequently wear-tested aboard eight ships on the east and west coasts for 9 months. Based on the test results, NCTRF recommended the Navy adopt the 100% cotton fabric with an FR ammonia-cured treatment.

During FY 87, NCTRF studied the protective characteristics of several military cold-weather clothing ensembles so that they could predict (1) how long personnel wearing these items could tolerate the ambient temperature and (2) how low the ambient temperature could fall before the wearer would no longer be comfortable in the clothing ensemble. NCTRF intends to use the data as reference information on existing cold-weather clothing and to allow ships deployed in cold environments to insure that their personnel wear adequately protective clothing. Specifically, NCTRF tested the Navy's cold-weather permeable, extreme-cold-weather impermeable, and standard submarine-deck exposure suits, the Army's wet and dry versions of the extreme-cold-weather ensemble, and a commercially available anti-exposure suit. To determine the reduction in clothing insulation with wind, these items were tested at four wind speeds. These measurements can be used to predict both tolerance times to a wide variety of climates and to the minimum ambient temperature at which a wearer would be comfortable.

In FY 87, NCTRF investigated state-of-the-art mathematical models to predict human responses to any combination of clothing, activity, and environment. First, Natick personnel conducted a literature search to assess the current use of mathematical modelling for human response. Next, they collected data from previous real-life situations involving human performance and tolerance in cold water, cold air, and high temperatures. Then, using the mathematical models, they calculated the human responses from each real-life scenario to learn which mathematical model would have predicted these responses most accurately. All models are based on one or more of three basic mathematical techniques: (1) steady-state mathematics in which the human body is assumed to have a constant rate of heat loss; (2) mathematics in which the temperature is assumed to be constant throughout the body; and (3) finite difference mathematics in which the body is divided into segments and the heat loss from each segment is calculated continuously after each brief increment of time (e.g., 0.1 sec). While the first two calculating methods permit a quick estimate of human response to a given condition, the third method best simulates reality, because it does not use limiting assumptions and does not require prediction of final conditions before beginning the calculations.

MAJOR ACCOMPLISHMENTS (CONTINUED)

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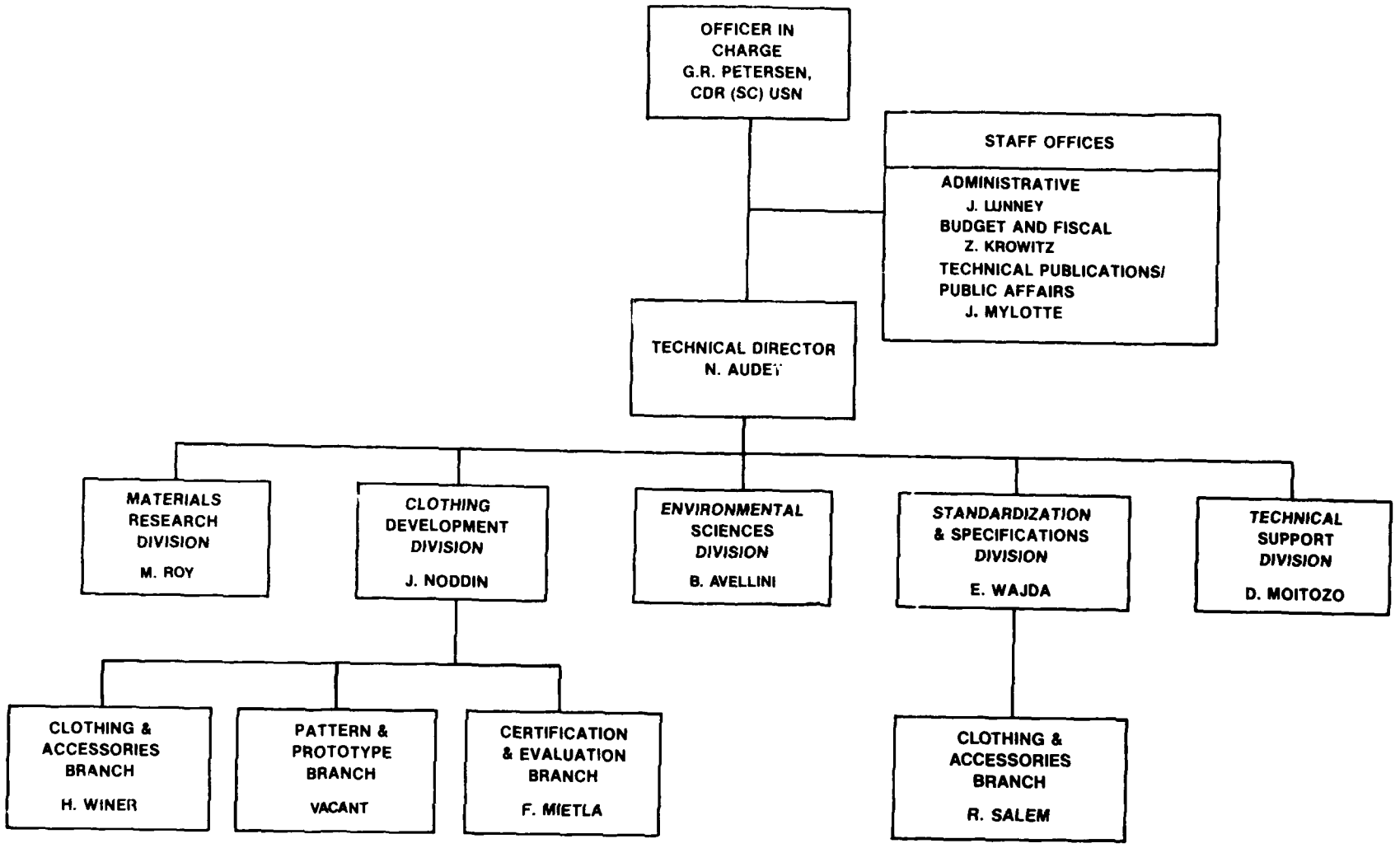
NCTRF

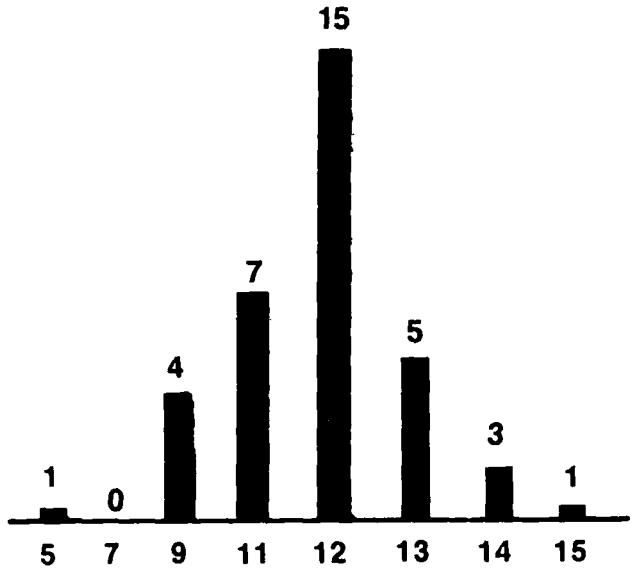


DATE:	APPROVED:	PARENT ORGANIZATION:	FIELD ACTIVITY:	CHART NO. 1 (REV.)
30 SEP 87	G.R. PETERSEN Commander, SC, USN Officer in Charge	NAVY RESALE AND SERVICES SUPPORT OFFICE	NAVY CLOTHING AND TEXTILE RESEARCH FACILITY	

NCTRF

PERSONNEL

ON BOARD:	MILITARY	CIVILIAN	FTP	FTP GRADED	FTP UNGRADED	TPTI *
	1	59	57	55	2	2



SCIENTISTS & ENGINEERS (BY GRADE)

ADMINISTRATIVE	4
CLOTHING DESIGNERS	3
TECHNICIANS	2
CLERICAL/OTHER	12
SCIENTISTS & ENGINEERS	36
TEXTILE TECHNOLOGISTS	27
ENGINEERS	4
CHEMISTS	2
PHYSIOLOGISTS	2
OTHER SCIENTIFIC	1

CIVILIAN CEILING
62

MILITARY ALLOWANCE
1 OFFICER

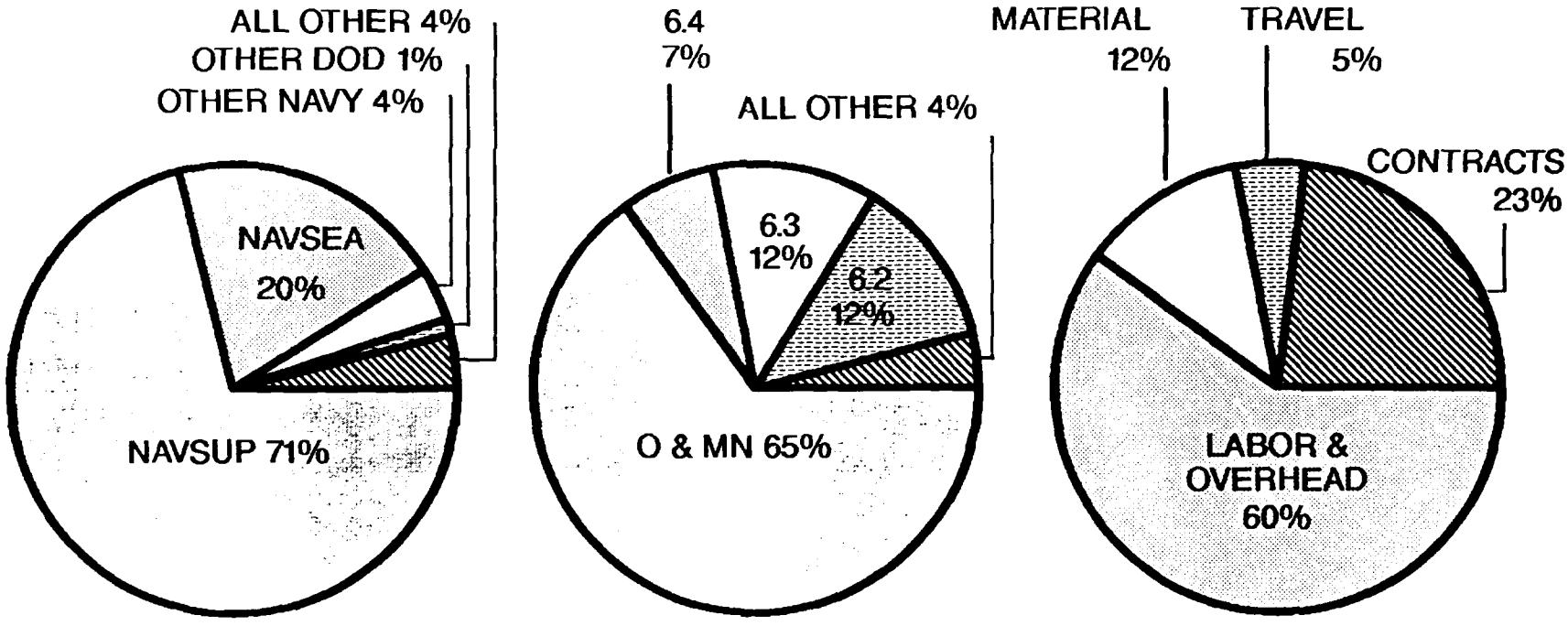
*Temporary, Part-time Intermittent (Summer Employees Excluded)

30 SEPTEMBER 1987

NCTRF

NOA

FY 87 - FUNDS



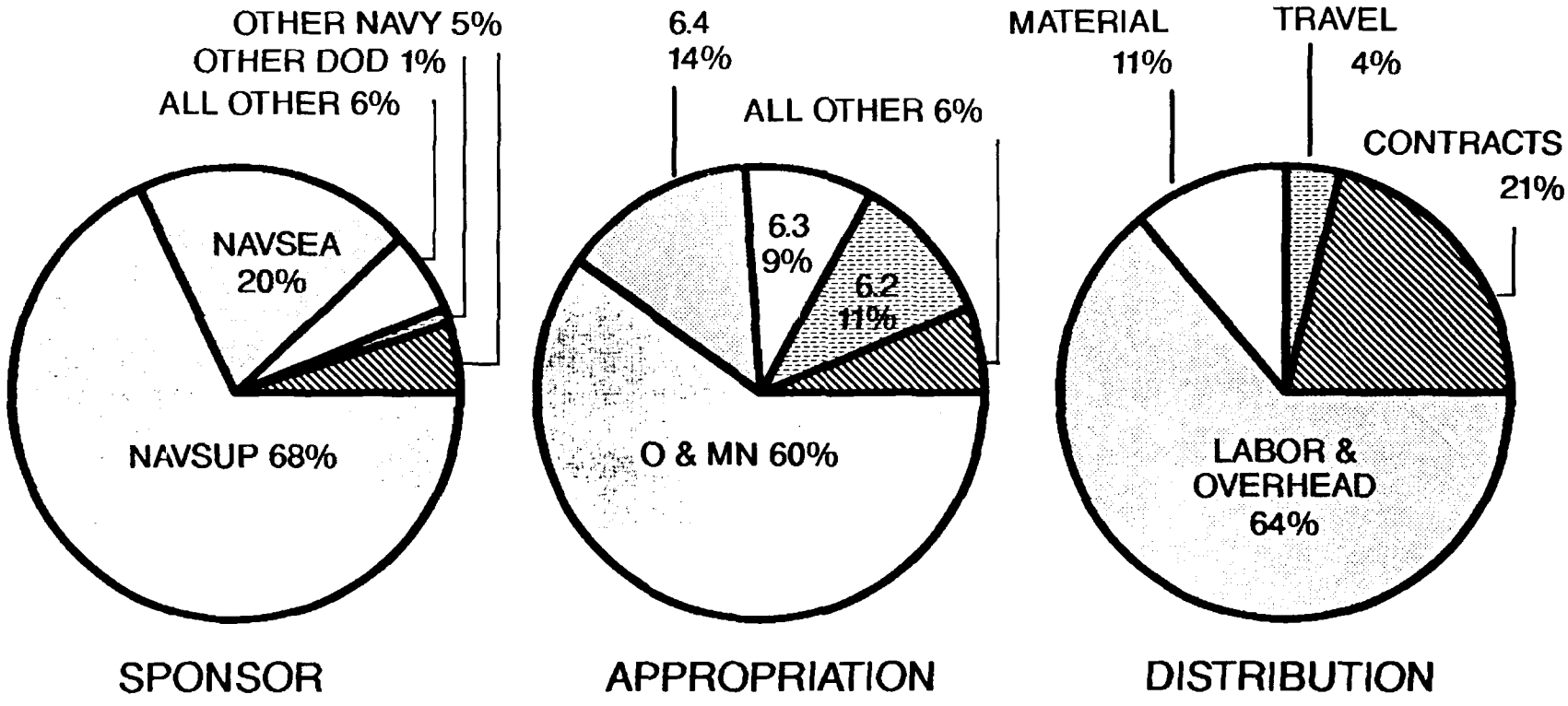
SPONSOR

APPROPRIATION

DISTRIBUTION

30 SEPTEMBER 1987

FY 88 FUNDS - ESTIMATE

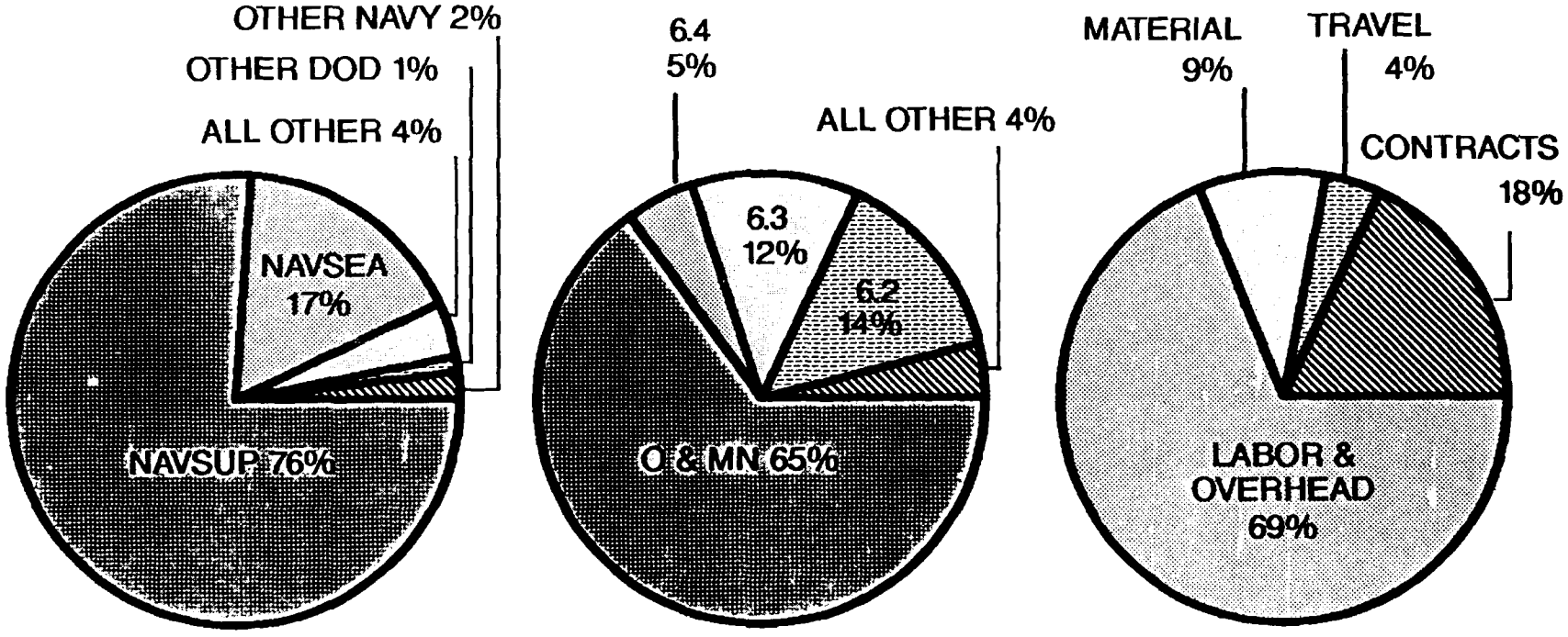


30 SEPTEMBER 1987

NCTRF

NOA

FY 89 FUNDS - ESTIMATE



30 SEPTEMBER 1987

NCTRF NOA

FUNDS BY CATEGORY AND TYPE

($ IN THOUSANDS)

CATEGORIES & TYPE	FY 1987			FY 1988			FY 1989		
	$	% OF		$	% OF		$	% OF	
RDT & E, N (CATEGORY)	ACT.	RDT & E	TOTAL	EST.	RDT & E	TOTAL	EST.	RDT & E	TOTAL
6.1 RESEARCH		-	-	-	-	-	-	-	-
6.2 EXPLORATORY DEVELOPMENT	425	38	12	375	32	11	493	46	14
6.3 ADVANCED DEVELOPMENT	435	39	12	320	28	9	400	37	12
6.4 ENGINEERING DEVELOPMENT	247	23	7	470	40	14	181	17	5
6.5 MANAGEMENT AND SUPPORT	-	-	-	-	-	-	-	-	-
6.6 OPERATIONAL SYSTEMS DEVELOPMENT	-	-	-	-	-	-	-	-	-
RDT & E, N SUBTOTAL	1,107	100	31	1,165	100	34	1,074	100	31
OTHER RDT & E	-	-	-	-	-	-	-	-	-
TOTAL RDT & E	1,107	100	31	1,165	100	34	1,074	100	31
OTHER APPROPRIATION									
(OPN) OTHER PROCUREMENT, NAVY	-	-	-	-	-	-	-	-	-
(O&MN) OPERATION & MAINTENANCE, NAVY	2,268	-	65	2,082	-	60	2300	-	65
OTHER	130	-	4	190	-	6	130	-	4
APPROPRIATION SUBTOTAL	2,398	-	69	2,272	-	66	2,430	-	69
TOTALS	3,505	-	100	3,437	-	100	3,504	-	100

30 SEPTEMBER 1987

NAVY CLOTHING AND TEXTILE RESEARCH FACILITY

NATICK, MASSACHUSETTS

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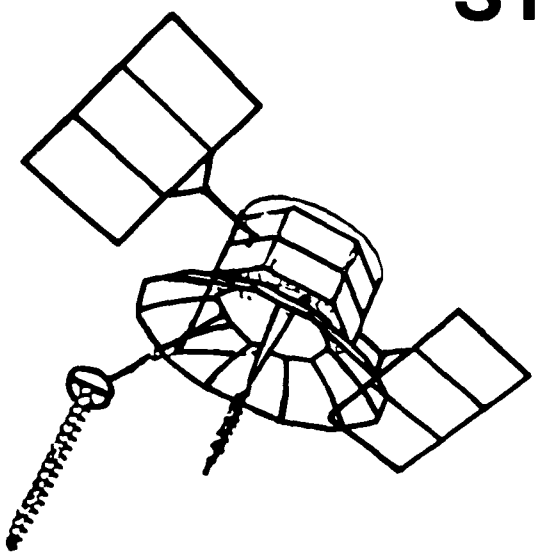
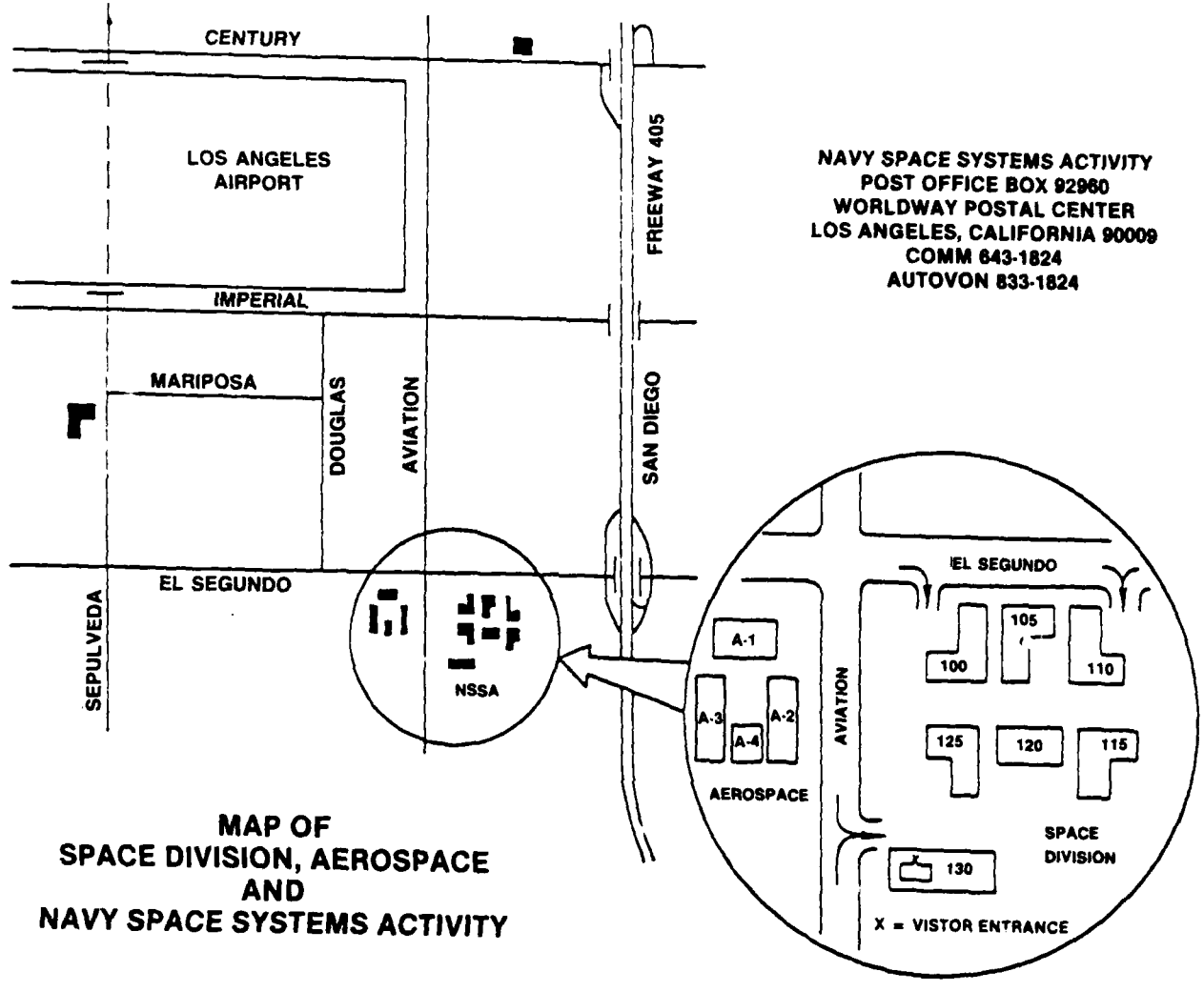
NAVY SPACE SYSTEMS ACTIVITY BRIEF



30 SEPTEMBER 1987



NAVY SPACE SYSTEMS ACTIVITY
POST OFFICE BOX 92960
WORLDWAY POSTAL CENTER
LOS ANGELES, CALIFORNIA 90009
COMM 643-1824
AUTOVON 833-1824

MAP OF SPACE DIVISION, AEROSPACE AND NAVY SPACE SYSTEMS ACTIVITY

30 SEPTEMBER 1987

MISSION

- PROVIDE FOR THE DEVELOPMENT OF ASSIGNED SPACE SYSTEMS
- PROVIDE FOR THE INTERFACES BETWEEN SPACE SYSTEMS AND OTHER NAVY SYSTEMS
- CONDUCT LONG RANGE STUDIES AND DEVELOPMENTS FOR SPACE EXPLOITATION
- PROVIDE MANAGEMENT AND ENGINEERING FUNCTIONS RELATED TO JOINT SERVICE SPACE DEVELOPMENTS
- COORDINATE WITH THE USAF SPACE DIVISION ON PROGRAMS OF MUTUAL INTEREST

30 SEPTEMBER 1987

INTRODUCTION

THE NAVY SPACE SYSTEMS ACTIVITY (NAVSPASYSACT) IS A R&D FIELD ACTIVITY OF SPAWAR, ESTABLISHED ON 10 AUGUST 1966, NAVSPASYSACT CHAMPIONS NAVY INTERESTS AS A TENANT ACTIVITY AT THE HEADQUARTERS USAF SPACE DIVISION IN LOS ANGELES, NAVSPASYSACT SERVES AS A DIRECT LINK BETWEEN THE AIR FORCE SPACE DIVISION COMMANDER AND COMMANDER, SPAWAR.

USAF SPACE DIVISION HAS PRIME RESPONSIBILITY FOR THE DEVELOPMENT, ACQUISITION AND/OR SUPPORT OF MOST MILITARY SPACECRAFT AND ASSOCIATED SYSTEMS. THIS RESPONSIBILITY INCLUDES MANY AREAS OF NAVY SPACE INTERESTS.

FORMAL AGREEMENTS WITHIN DOD SPECIFY THAT THE NAVY WILL USE USAF SPACE ASSETS TO THE MAXIMUM EXTENT POSSIBLE IN THE DEVELOPMENT AND DEPLOYMENT OF NAVY SPACE SYSTEMS. USAF ASSETS ARE NORMALLY UTILIZED FOR LAUNCHING AND TRACKING NAVY SPACECRAFT, HOWEVER, THE NAVY RETAINS FULL RESPONSIBILITY FOR THE EXPLOITATION OF SPACE TO MORE EFFECTIVELY ACCOMPLISH THE NAVY'S MISSION.

THE COMMANDER, SPACE AND NAVAL WARFARE SYSTEMS COMMAND IS RESPONSIBLE FOR EVERY PHASE OF SPACE ACQUISITION FROM CONCEPTUALIZATION OF SPACE SYSTEMS, RESEARCH AND DEVELOPMENT, THROUGH PROCUREMENT, INTEGRATION AND OPERATION. A PORTION OF THIS EFFORT IS ASSIGNED TO THE NAVSPASYSACT AND ACCOMPLISHED THROUGH JOINT SERVICE PROGRAMS AND AN ESTABLISHED NETWORK OF CONTACTS WITH USAF PROGRAM OFFICES AND THE AEROSPACE INDUSTRY IN LOS ANGELES. SOME CAPABILITY IS MAINTAINED WITHIN THE STAFF AT NAVSPASYSACT TO PROVIDE ENGINEERING ANALYSIS AND EVALUATION OF SPACE SYSTEMS. THE TIMELY EXPLOITATION OF THE INHERENT PROPERTIES OF SPACE BASED SYSTEMS WILL ENHANCE THE NAVY'S ABILITY TO CARRY OUT ITS MISSION. NAVSPASYSACT IS COMMITTED TO THAT GOAL.

AS OF 30 SEPTEMBER 1987, NAVSPASYSACT HAD 28 FULL TIME CIVILIAN POSITIONS AND A MILITARY ALLOWANCE OF 20 OFFICERS.

FACILITIES

NAVSPASYSACT IS LOCATED ON THE LOS ANGELES AIR FORCE BASE, LOS ANGELES, CA. THE COMMAND SECTION AND ONE DEPARTMENT OCCUPY A SECTION ON THE SECOND FLOOR OF BUILDING 130 UNDER A HOST-TENANT AGREEMENT WITH THE USAF SPACE DIVISION. MOST ACTIVITY PERSONNEL DIRECTLY INVOLVED IN MUTUAL INTEREST PROGRAMS WITH THE SPACE DIVISION ARE ASSIGNED OFFICE/WORK SPACE COLOCATED WITH THEIR AIR FORCE COUNTERPARTS.

PROGRAM WORK

SPACE TRANSPORTATION

PROVIDE NAVY LIAISON WITH DOD AND NASA PROJECT OFFICES IN ORDER TO EFFECTIVELY UTILIZE AMERICA'S SPACE LAUNCH AND CONTROL SYSTEMS IN SUPPORT OF THE NAVY'S MISSIONS

SPACE TEST PROGRAM (STP)

EXECUTIVE AGENT FOR MANAGEMENT OF NAVY PARTICIPATION IN STP. PROVIDE LIAISON WITH AF SPACE DIVISION STP OFFICE FOR ALL NAVY EXPERIMENTS.

DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

PROVIDE ACQUISITION SERVICES AND DEPOT LEVEL ENGINEERING SUPPORT FOR RECEIVERS AND DATA REDUCTION EQUIPMENT INSTALLED ABOARD NAVY SHIPS AND STATIONS FOR COLLECTION AND PROCESSING OF METEOROLOGICAL DATA FROM DEFENSE METEOROLOGICAL SATELLITES. ASSIST THE AIR FORCE IN THE DEVELOPMENT, ACQUISITION AND LAUNCH OF ADVANCED SPACE SENSORS TO MEASURE OCEAN AND ATMOSPHERIC CONDITIONS. ASSIST THE NAVY IN THE DEVELOPMENT AND PROCUREMENT OF MARK IV TRANSPORTABLE TACTICAL TERMINALS FOR THE U.S MARINE CORPS AND RELATED MODIFICATIONS.

NAVY REMOTE OCEAN SENSING SYSTEM (NROSS)

PROVIDE ANALYSES OF MASS PROPERTIES STRUCTURAL LOADS, DATA FORMAT, AND LOW FREQUENCY MICROWAVE RADIOMETER DESIGN. DEVELOP SYSTEM SPECIFICATIONS AND PROVIDE FOR INTEGRATION OF SATELLITE SYSTEMS WITH LAUNCH VEHICLE AND COMMAND AND CONTROL NET. ASSIST PMO IN ACQUISITION OF LAUNCH VEHICLE AND COMMAND AND CONTROL SYSTMS FOR N-ROSS. SUPPORT N-ROSS SOURCE SELECTION, AND FOLLOW-ON TECHNICAL EVALUATIONS.

FLEET SATELLITE COMMUNICATIONS (FLTSATCOM)

PROVIDE MANAGEMENT AND TECHNICAL SUPPORT FOR THE FLTSATCOM SPACE SEGMENT PROCUREMENT AND OPERATION. PROVIDE MANAGEMENT AND TECHNICAL SUPPORT FOR AN EHF CAPABILITY ON FUTURE FLTSATCOM SATELLITES.

UHF FOLLOW-ON (UFO) SATCOM

PROVIDE TECHNICAL OVERSIGHT AND NAVY LIAISON WITH WEST COAST CONTRACTORS, THE AEROSPACE CORPORATION AND THE AIR FORCE SPACE DIVISION RELATIVE TO PAYLOAD DESIGN, SHUTTLE INTEGRATION, INTEGRATION, LAUNCH AND OPERATION OF THE UHF FOLLOW-ON SATELLITES

NAVSTAR GLOBAL POSITIONING SYSTEM (GPS)

PROVIDE A MANAGEMENT/TECHNICAL TEAM TO ADMINISTER THE NAVY CONTRIBUTION TO DEVELOPMENT OF GPS. INVOLVEMENT INCLUDES ALL SEGMENTS AND ASPECTS OF SYSTEM DEVELOPMENT AND INTEGRATION AND TEST (IOT&E) ON THREE NAVY PLATFORMS. PLANNING FOR PRODUCTION AND INTEGRATION WITH MANY ADDITIONAL PLATFORMS.

SLOW WALKER REPORTING SYSTEM (SWS)

PROVIDE PRINCIPAL DEVELOPMENT ACTIVITY (PDA) SUPPORT FOR ACQUISITION OF NAVY SWRS CAPABILITY AT AN EXISTING CONTINENTAL GROUND STATION.

BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS)

PROVIDE NAVY TECHNICAL AND MANAGEMENT SUPPORT TO EXISTING USAF CONTRACTS FOR POSSIBLE NAVY PARTICIPATION IN FUTURE YEARS.

MAJOR ACCOMPLISHMENTS
FY 87

DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

MANAGED THE OVERHAUL OF TWO AN/SMQ-10 METEOROLOGICAL SATELLITE DATA (METSAT) SHIPBOARD RECEIVING TERMINAL FOR CV-65 & CV-66. NEGOTIATED OPTIONS ON AN EXISTING CONTRACT FOR PROCUREMENT OF 5 MARINE MARK IV RECEIVING TERMINALS. MANAGED UPGRADE OF THE MARINE MARK IV DISK SUBSYSTEM. APPROVED AND MANAGED THE INSTALLATION OF THE BASELINE SSM/I SYSTEM SOFTWARE AT FLEET NUMERICAL OCEANOGRAPHY CENTER. PARTICIPATED IN EVALUATION OF NUMEROUS N-ROSS STUDIES. MANAGED THE DEVELOPMENT OF A LIGHT CARRY ON-BOARD TIROS REALTIME DATA SMOOTH (RDS) RECEIVER TERMINAL.

NAVY REMOTE OCEAN SENSING SYSTEM (NROSS)

ASSISTED PMO THROUGH ENGINEERING STUDIES AND TECHNICAL ANALYSES OF COMMAND AND CONTROL GROUND SYSTEM DESIGNS. MONITORED AND COORDINATED THE ACQUISITION OF SSM/I INSTRUMENTS FOR S11-S15 AND N-ROSS. ASSISTED PMO IN ACQUISITION AND INTEGRATION OF THE N-ROSS SATELLITE WITH LAUNCH VEHICLE AND COMMAND AND CONTROL GROUND SYSTEMS. PARTICIPATED IN WRITING AND EVALUATING THE RFP FOR SSM/I FOLLOW ON INSTRUMENT ACQUISITION FOR S16-S20 SPACECRAFT.

GLOBAL POSITIONING SYSTEM (GPS)

PROVIDED PROGRAM MANAGEMENT FOR POST-DAB LIMITED RATE PRODUCTION, TEST AND EVALUATION, AND DELIVERY OF PRE-PRODUCTION ENGINEERING PROTOTYPE GPS USER EQUIPMENT. BEGAN ACCEPTING PRODUCTION PROTOTYPE USER EQUIPMENT AT NAVY SILS FOR PHASE III DT/OT TEST PROGRAM. SUPPORTED SECOND-SOURCE SELECTION IN PREPARATION OF COMPETING GPS FOLLOW-ON FULL-RATE PRODUCTION CONTRACT.

SPACE TEST PROGRAM (STP)

PLAYED A CRITICAL ROLE IN AN OVERALL REDIRECTION OF THE STP PROGRAM THAT OCCURRED WITH THE CESSATION OF SHUTTLE FLIGHTS AFTER THE CHALLENGER ACCIDENT. NEW FLIGHT OPPORTUNITIES FOR NAVY SPONSORED PAYLOADS HAVE BEEN IDENTIFIED THAT ARE BOTH MORE CAPABLE AND COST-EFFECTIVE. NAVY SPACE SYSTEMS ACTIVITY HAS PLAYED A PIVOTAL ROLE IN THE ESTABLISHMENT OF THE DOD MILITARY MAN IN SPACE PROGRAM.

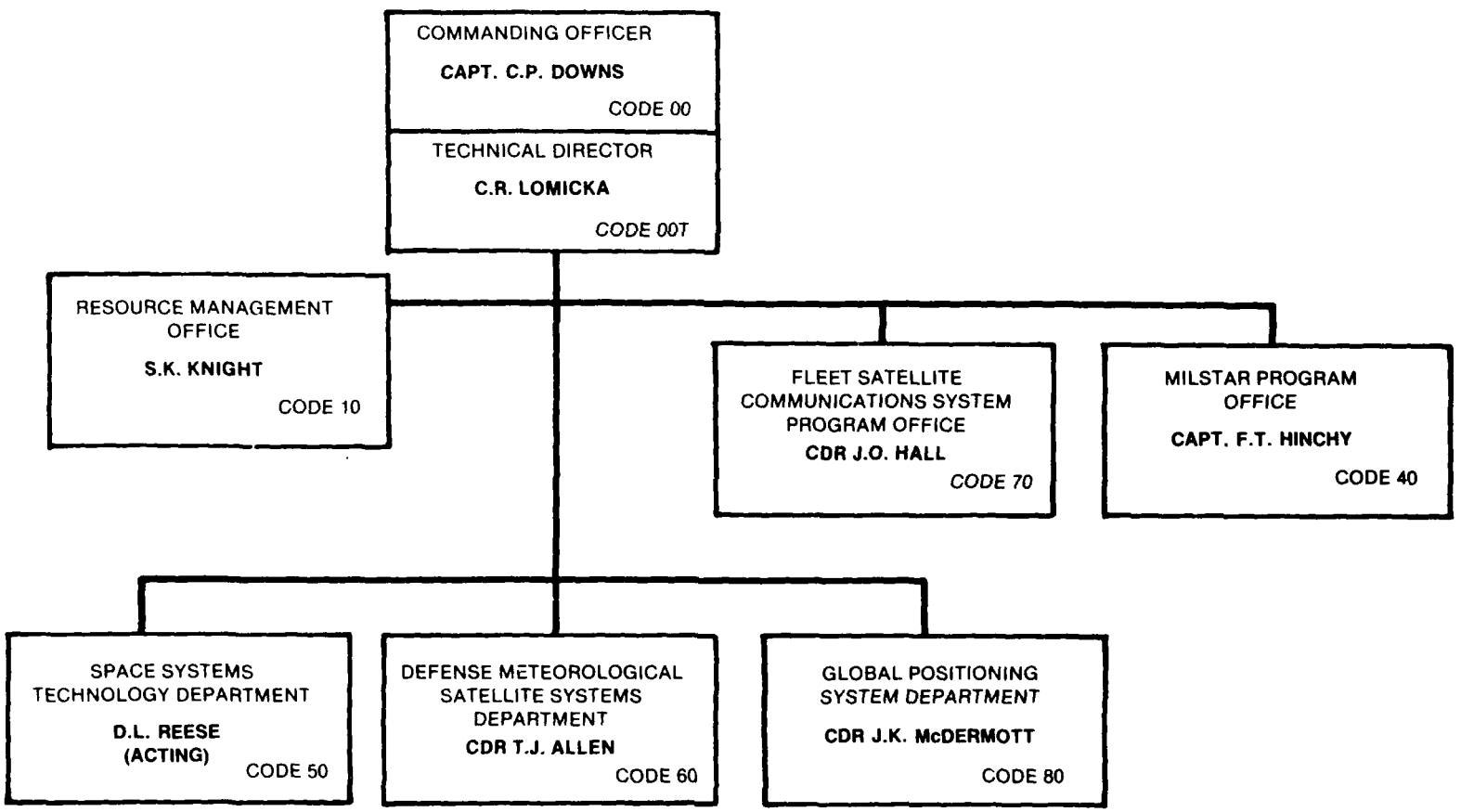
SATELLITE COMMUNICATIONS

CONTINUED SUPPORT OF PRODUCTION OF FLEET SATELLITE COMMUNICATION (FLTSATcom) SYSTEM. PROVIDED SUPPORT TO MISSION DIRECTOR OF LAUNCH OF FLTSATCOM FLIGHT 7 AND 6. SUCCESSFULLY LAUNCH FLIGHT 7, WITH AN EHF PACKAGE ON BOARD, 13 DEC 86 AND PLACED IN SERVICE IN EARLY JANUARY. LOST FLIGHT 6 DUE TO LIGHTING STRIKE DURING LAUNCH ON 26 MARCH 87. PROVIDED ENGINEERING AND PROGRAM SUPPORT FOR THE UHF FOLLOW-ON PROGRAM.

SLOW WALKER REPORTING SYSTEM (SWRS)

DESIGNED AND INSTALLED SWRS MANUAL CAPABILITY AT A CONTINENTAL GROUND STATION (CGS) AND PROVIDED FOR ENHANCED MANUAL CAPABILITY TO BE AVAILABLE IN CY 1988. COMPLETED PLANNING FOR AUTOMATIC SWRS CAPABILITY AT CGS AND BEGAN NEGOTIATION WITH CONTRACTOR VIA AN EXISITNG USAF CONTRACT TO PROVIDE AUTOMATIC CAPABILITY.

ORGANIZATION



30 SEPTEMBER 1987

PERSONNEL DATA

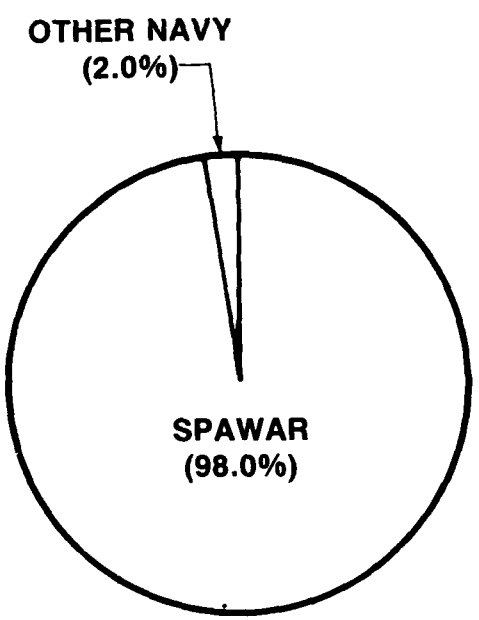
PERSONNEL CEILING.:		
CIVILIAN	MILITARY ALLOWANCE:	
	OFFICER	ENLISTED
28	20	0

TOTAL ON BOARD	TOTAL MILITARY	TOTAL CIVILIANS	FTP	TPTI	FTP UNGRADED	FTP GRADED
39	14	25	24	1	0	24

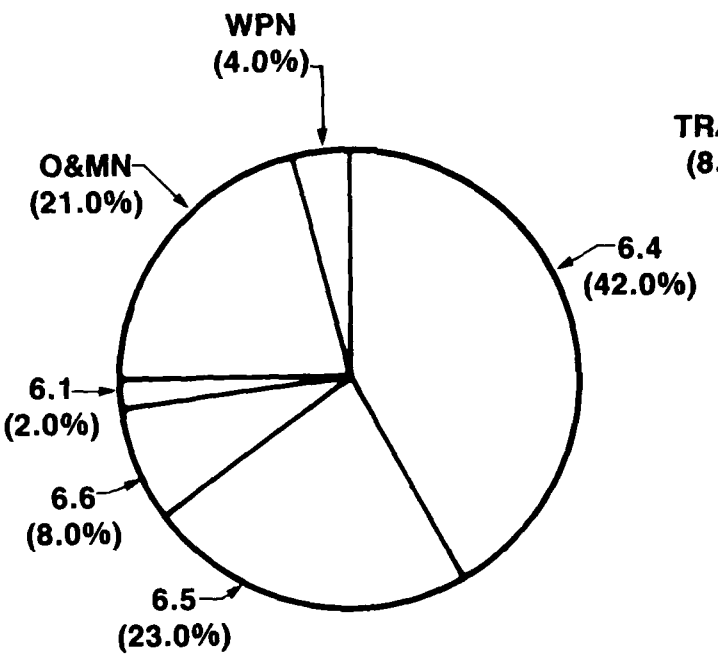
CIVILIAN PERSONNEL BY DISCIPLINE	
SCIENTIST AND ENGINEERS	16
ADMINISTRATIVE	6
TECHNICIANS	2
CLERICAL	4

30 SEPTEMBER 1987

FY 87 - FUNDS



BY SPONSOR



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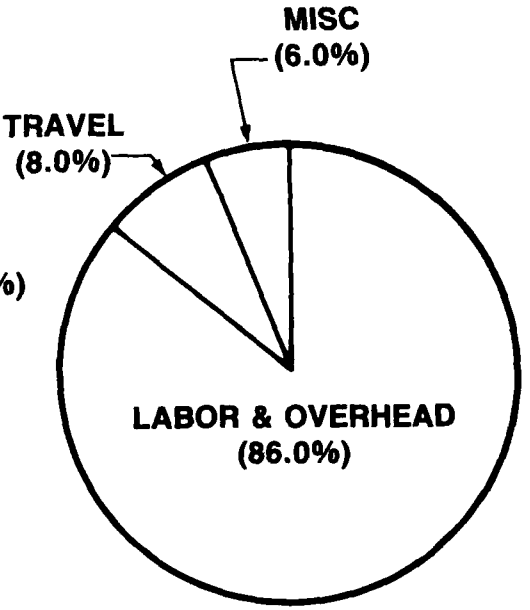
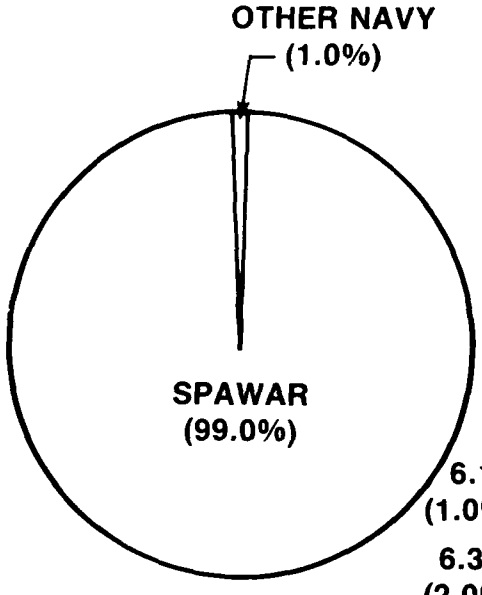


DISTRIBUTION

30 SEPTEMBER 1987

FY 88 - FUNDS-ESTIMATE



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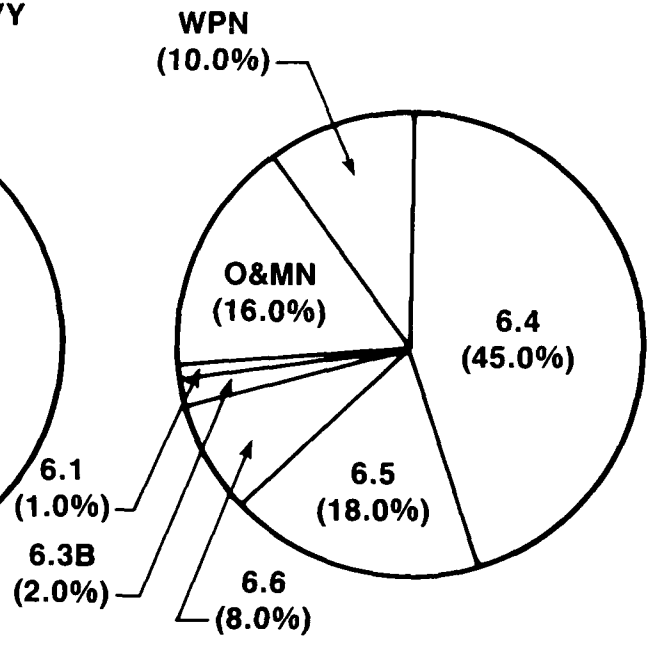

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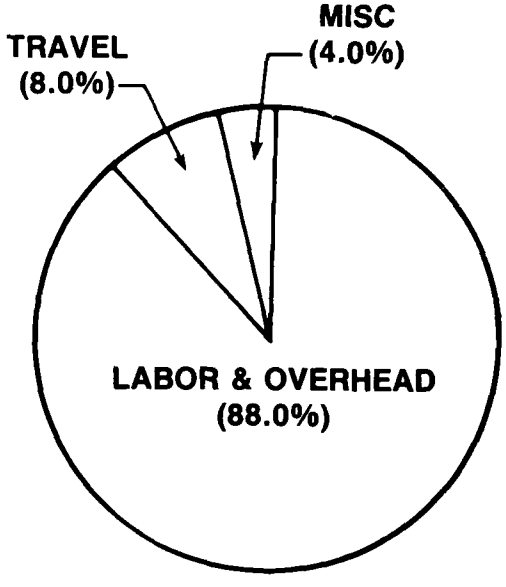
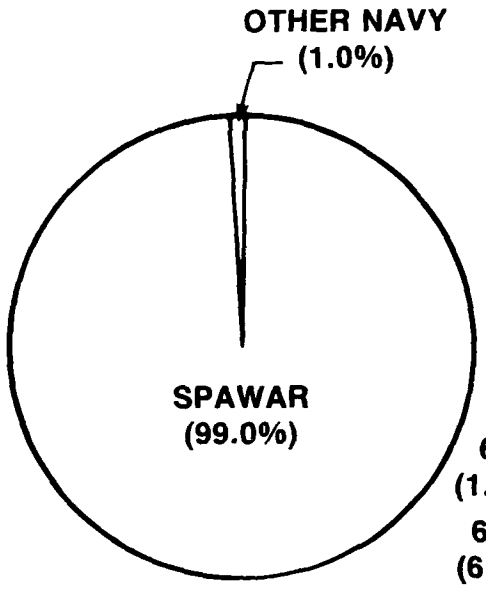


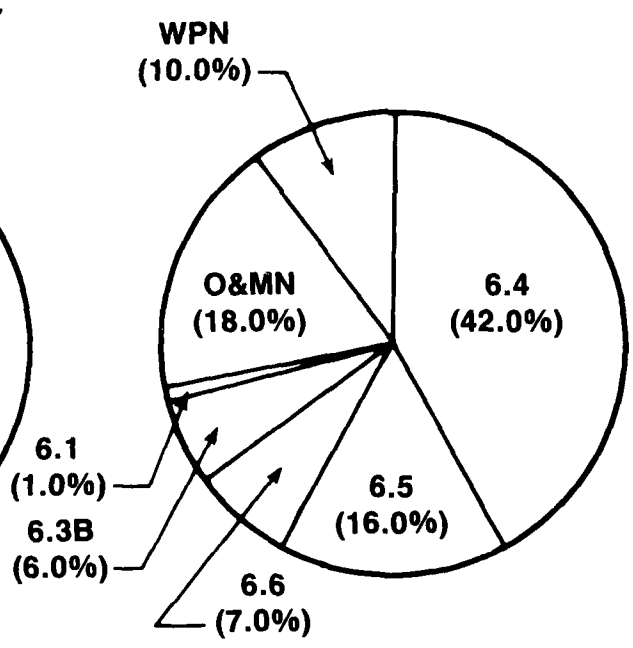
DISTRIBUTION

30 SEPTEMBER 1987

FY 89 - FUNDS-ESTIMATE



BY SPONSOR



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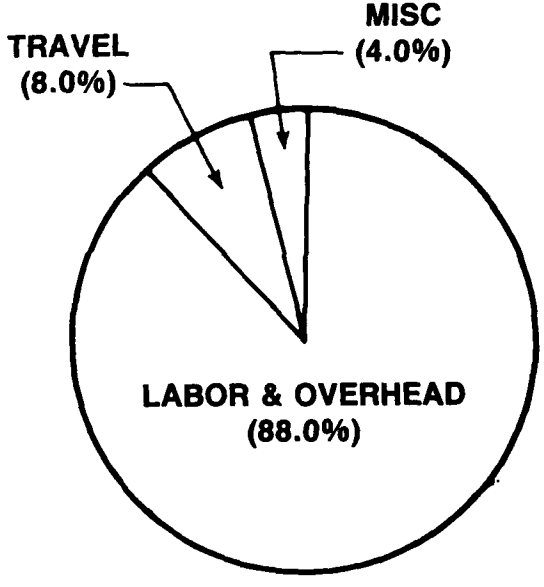

DISTRIBUTION

30 SEPTEMBER 1987

FUNDS BY CATEGORY AND TYPE (NOA)

$ IN THOUSANDS

CATEGORIES & TYPE	FY1987 $ ACT.	FY1987 % OF RDT&E	FY1987 % OF TOTAL	FY1988 $ EST.	FY1988 % OF RDT&E	FY1988 % OF TOTAL	FY1989 $ EST.	FY1989 % OF RDT&E	FY1989 % OF TOTAL
RDT&E, N (CATEGORY)									
6.1 RESEARCH	21	2.0	2.0	18	2.0	1.0	20	2.0	1.0
6.2 EXPLORATORY DEVELOPMENT	-	-	-	-	-	-	-	-	-
6.3a ADVANCED TECHNOLOGY DEVELOPMENT	-	-	-	-	-	-	-	-	-
6.3b ADVANCED DEVELOPMENT	-	-	-	35	3.0	2.0	100	8.0	6.0
6.4 ENGINEERING DEVELOPMENT	519	55.0	42.0	702	61.0	45.0	738	58.0	42.0
6.5 MANAGEMENT AND SUPPORT	296	32.0	23.0	280	24.0	18.0	286	22.0	16.0
6.6 OPERATIONAL SYSTEMS DEVELOPMENT	100	11.0	8.0	117	10.0	8.0	125	10.0	7.0
TOTAL RDT&E.....	936	100.0	75.0	1152	100.0	74.0	1269	100.0	72.0
OTHER APPROPRIATION	-	-	-	-	-	-	-	-	-
(OPN) OTHER PROCUREMENT, NAVY	269	-	21.0	238	-	16.0	313	-	18.0
(O&MN) OPERATION & MAINTENANCE, NAVY	50	-	4.0	160	-	10.0	171	-	10.0
(WPN) WEAPON PROCUREMENT, NAVY	-	-	-	-	-	-	-	-	-
APPROPRIATION SUB TOTAL	319	-	25.0	398	-	26.0	484	-	28.0
TOTALS	1255	-	100.0	1550	-	100.0	1753	-	100.0

30 SEPTEMBER 1987